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Improved ARTEP Methods for Unit Evaluation

VOLUME V: ANALYSIS OF ALTERNATIVE TRAINING SETTINGS

by

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This study analyzed alternative training settings available to battalion training managers for the conduct of training battalions and their elements within ARTEP. Nine settings were selected for study: conventional field exercises, engagement simulation field exercises (REALTRAIN and MILES), battalion command/staff battle simulations, CATTS, CAMMS, Pegasus, company/platoon battle simulations, Dunn-Kempf and SCUE, tactical exercises without troops (TEWT) and Command Post Exercises (CPX). Each setting was narratively described on 35 dimensions, including scenarios, presentation of tasks to participants, ARTEP 71-2 missions/

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19. Combined Arms Tactical Training Simulator (CATTS)
Computer-Assisted Map Maneuver System (CAMMS)
Small Combat Unit Evaluation Game (SCUE)

20. tasks exercised by each setting, administrative personnel and resource requirements, and capability for performance measurement/diagnosis. Settings were organized into two groups: field exercises and battle simulations. Comparisons were made between and within clusters to determine advantages and limitations of settings in the battalion training environment. Factors affecting the training value of all settings are discussed. Example sequences and combinations of settings are presented for different battalion elements. Primary audiences are researchers, TRADOC/FORSCOM personnel responsible for collective training policy, and battalion training managers.

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CHAPTER 1

INTRODUCTION

1-1. INTRODUCTION

This is one report from the second phase of a two-phase research project conducted by HSR for the Army Research Institute (ARI). The objective of the project is to provide guidance for improving the conduct of ARTEP field exercises so they can be used as better training vehicles.

In the first project year, several battalion level field exercises were observed. Problems of planning and execution were noted.[1,2] Another second year report[3] has taken these problems into account and provided guidance to planners of exercises and a program of instruction for evaluators/controllers involved in conduct of company and platoon level field exercises.

This report addresses another issue which stems from year-one observations. This issue is that of establishing the best mix of training settings, either in preparation for, or after the conduct of full-scale battalion exercises. Time and resource constraints do not normally allow for repetition of such exercises, nor is it clear that repeating battalion field exercises is the best approach to training. Alternate means for correcting training deficiencies observed during training must be found. These alternate modes, or training settings, should support the concept of concurrent, multi-echelon training. These training settings must be cost-effective. Finally, they should provide battalion training managers and trainers with viable options in planning and conducting training for a battalion and its subelements.

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[1] *Improved Army Training and Evaluation Program (ARTEP) Methods for Unit Evaluation– Volume I, Executive Summary: Study Design and Field Research.* ARI Technical Report TR-78-A26. November 1978.

[2] *Improved Army Training and Evaluation Program (ARTEP) Methods for Unit Evaluation– Volume II, Analysis.* ARI Technical Report TR-78-A26. November 1978.

[3] *Improved Army Training and Evaluation Program (ARTEP) Methods for Unit Evaluation– Volume IV, Guidance for Planning and Conduct of Company-Level Field Exercises.* Final Technical Report. Human Sciences Research, Inc., McLean, Virginia: 30 April 1979.

1-2. THE CHALLENGE OF COLLECTIVE (UNIT) TRAINING

Army personnel are committed to combat as units, not as individuals. The efficient management and conduct of unit training continues to pose a serious challenge, a challenge that looms larger as we look to the battlefields of the future. A next war, should it occur, has been referred to as a "come as you are" war. Thus, it is critical to maintain a high state of unit readiness.

Several features of the modern battlefield help to set requirements for unit training. Modern technology has produced weapons with increasing capabilities, range and lethality. Soldiers and crews must know how to operate and maintain these weapons. Leaders must be able to employ the combined capabilities of weapons effectively. Tracked vehicles provide great increases in mobility. Instead of walking or staying in foxholes, soldiers ride to the battle and may well fight from their vehicles. Mobile armor and artillery equipment demand rapid deployment and redeployment. Close air support is an integral part of Army battlefield doctrine. These elements, taken together, place greater demands on leaders and their units. Increased lethality of weapons and mobility means that units are more dispersed and that the battle proceeds at a quicker pace. Effective tactical deployment and maneuver, command, coordination, communication and control become critical requirements. Further, as the number of echelons that need to operate in unison increases, demands placed on units for which commanders are responsible increase. Thus, training of units as battle-effective teams poses a tremendous challenge.

The challenge has another critical dimension. It must be prepared for in a peacetime environment which is increasingly austere. Costs of modern weapon systems continue to escalate. Added constraints are placed on training resources: maneuver areas; time; personnel; and funds. These conditions, taken together, mean that maximum benefit must be derived from each hour of collective training. This is the situation that confronts the Army today.

This situation, in turn, places demands on training managers of operational units, on Department of the Army personnel responsible for providing policy and guidance, and on Army agencies that conduct research to support training. Let us for a moment examine the perspectives of each of these sources.

1-3. IMPLICATIONS FOR TRAINING MANAGERS, HEADQUARTERS, AND RESEARCH

a. Training Managers. The training managers and trainers at battalion level and below must, on a day-to-day basis, balance training needs and requirements against available resources. The first obvious problem is to define training needs. From World

War II until the early 1970's, Army training programs proceeded according to a lock-step, sequenced training schedule whereby squads, then platoons, companies and battalions were trained in an established progression. ATTs (Army Training Tests) were provided for guidance. (Whatever the faults of this approach as applied to peacetime training, everyone could understand and direct their activities so as to implement the schedule.) There was then little occasion to define training needs. Implicit at least in the schedule was the assumption that each element "needed" all training provided.

The battalion training manager is made responsible for determining training needs under the current collective training philosophy embodied by ARTEP. He is instructed to plan and conduct training on a decentralized basis, not by a division-determined master training schedule. He is encouraged to institute concurrent, multi-echelon training. In sum, training managers have inherited a greater amount of responsibility for planning and management. But explicit guidance for conduct of concurrent, multi-echelon training is needed. The ARTEP Mission T&EOs (Training and Evaluation Outlines) represent an improvement over the ATTs. But these, plus documents such as TC 21-5-7 (Training Management in Battalions), still leave managers at battalion level much to figure out for themselves in defining needs and in adapting training to these needs.

Concurrently, in situations often characterized by personnel turbulence, managers must work with limited resources. Often personnel available are both ever-changing and inexperienced. The manager can expect that within a given year, fully 50 percent of battalion personnel will have either left and been replaced or assumed new jobs within the battalion. Further, the personnel at both soldier and leader levels often do not have the experience necessary. They can be, and in many cases are, unfamiliar with their own tasks. Therefore, they are not ready to fully assume the role of knowledgeable trainers for the unit to which they are assigned.

The battalion training manager also has a problem with time. "It is the most critically needed and seriously depleted training resource."[4] Equipment maintenance, on-duty individual education programs, special duties required in support of post or garrison support activities, and personnel administrative and medical requirements all detract from the availability of personnel for training. It is then difficult to field a fully-manned units.

The battalion training manager is in constant competition for training facilities and training areas. His requirements must be balanced with those of the other battalions and reserve and national guard components. The result is that only one-third of any given year can be devoted to training with appropriate training facilities or maneuver areas.

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[4] *Army Command and Management, Volume 2: Operations.* Carlisle Barracks, Pennsylvania: Department of Command and Management, 1976.

The training manager is also constrained in terms of supplies and funds available for training activities. Both POL and munitions are increasingly restricted items. Further, in the budgetary process, quantifiable and countable supplies such as munitions, etc., are in direct competition for the resource dollar with training activities which are more difficult to quantify. Thus, the training manager is tempted and succumbs to trading off, using his resource dollars for things he can count, such as field equipment, instead of for things that he can't count, such as the value of a week of training in the field.

Finally, the training manager needs guidance, tools, and solutions that he can apply to satisfy training needs within his resource limitations. For years, the field-based exercise, along with–perhaps–Command Post Exercises (CPXs) for the battalion staff, represented the usual vehicles for training. Given few available alternatives, the fact that the field exercise was expensive or resource intensive was accepted. Now, faced with severe resource constraints, the training manager needs alternative tools and solutions to problems of meeting training needs while working within time, personnel, facility and monetary constraints.

b. **Department of the Army**. The Department of the Army, through TRADOC and FORSCOM, provides policy and guidance for training managers. Recently, these commands have suffered serious erosions of resources devoted to the training base. Further, in the shift to performance-oriented training, development of guidance for collective training has lagged behind development of guidance and tools for training of individuals. Here, the Instructional Systems Development (ISD) approach, Training Extensive Course (TEC) packages, resident advanced individual training and skill refresher courses have been implemented.

'Unit training guidance is more difficult to design and implement for several reasons. First, it is much easier to evaluate and modify curricula for individuals than curricula for groups. Second, the models used for individual training are perhaps less than completely adequate as guides for conduct of collective training which, among other things, must emphasize multi-channel communications, inter-unit interactions, and command data processing. TRADOC recognizes the need for further guidance in collective training systems and is actively involved in developing solutions.

c. **The Research Perspective**. Research can help to better describe problems of training. It can provide concepts and tools that can help managers better cope with problems of maintaining unit proficiency in a peacetime environment. Three reports of this Phase II study provide different but complementary avenues of approach.

- Phase I field observations led us to believe that field exercises can be better employed for training diagnosis and training. A key approach is through better planning and improved evaluator training. Accordingly, one report of this series provides guidance for training managers for conduct of field exercises, and lesson plans for evaluator training.[5]

- Advances in technology may be exploited to improve the quality of unit training. A recent development in which ARI has played a prominent role is referred to as engagement simulation. A second report of this series compares conventional exercises with those that employ engagement simulation. The objectives is to provide guidance by which engagement simulation can be integrated into ARTEP.[6]

- This report stems from a recognition that battalion field exercises have limitations both in diagnosing training deficiencies and as a vehicle for remedial training. In both respects, battalion exercises are best as training methods for the battalion staff, next best for training company commanders. Their value in training platoons and squads or vehicle crews is limited. In particular, battalion field exercises are a cumbersome means of providing remedial training.

  There are other means of training units and leaders—some old and some relatively new—which can be utilized. Among these are developments in battle simulation. This report analyzes nine modes of collective or unit training, referred to here as training settings, in order to evaluate their value as tools for training battalions and their elements.

1-4. SUMMARY AND OVERVIEW OF THIS DOCUMENT

The needs of training managers in an austere environment call for more flexible approaches to collective or unit training.

Field exercises are the traditional mode of training for Army units. The limited time available for collective training severely constrains opportunities to conduct field exercises. Field exercises are resource intensive, so resource intensive that during any given time period, not many of them can be afforded. As presently practiced, field exercises at the battalion level, at least, do not offer comprehensive opportunities for

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[5] ARI Technical Report TR-78-A26, Volume I, *op. cit.*, November 1978.

[6] ARI Technical Report TR-78-A26, Volume II, *op. cit.*, November 1978.

practice of combat relevant skills by lower echelon personnel and feedback in terms of training strengths and weaknesses on those combat skills. The responsibility for decentralized training and concurrent multi-echelon training make it desirable that training managers have greater flexibility in selection of vehicles for training.

Given these considerations, search for alternative training settings to supplement or complement the field training exercise for the combined arms battalion and its elements is timely. The merits of alternative settings and the possibility of using them to provide the battalion training managers with suitable options need to be fully explored. Guides for planning training so as to best exploit the capabilities and limitations of various training settings must be developed with sensitivity to costs and training effectiveness, given the austere resource environment in which the training manager and the Army must operate.

This report provides an initial, systematic look at alternative training settings for a battalion and its elements. It identifies available training settings and describes each on some 35 parameters. Settings are compared on these parameters as they represent choices available to battalion training managers. Recommendations bear on selection of training settings and sequencing their use in a battalion training program. A discussion of features common to the effective use of any training setting is provided. Recommendations and issues are discussed from the perspective of training managers, Department of the Army TRADOC and FORSCOM level management, and research organizations.

In summary, this work represents an initial attempt to compare the relative merits of some nine settings for the conduct of training of tactical units and their leaders. While a substantial body of material is available on some of the individual settings, as far as we know, this represents a first attempt to compare relative merits across so large a spectrum of settings. Thus, this report can best be thought of as an attempt to summarize the current state of knowledge. Hence, our conclusions and recommendations are best regarded as hypotheses–hypotheses which can guide more incisive empirical investigations. Until such investigations are made, this report is intended to provide guidance for personnel responsible for training management.

Finally, the several training settings now available provide the training manager a greater variety of options than he has had before. He stands to be better able to select those settings that are most appropriate to training needs of particular elements. Still, selecting the best setting does not guarantee effective training. Good planning, careful preparations, and follow up by effective execution are always important.

CHAPTER 2

DEVELOPMENT OF DESCRIPTIONS OF TRAINING SETTINGS

2-1. DEFINITION OF A TRAINING SETTING

Training settings of the type discussed here represent situations which battalions and their elements confront in combat. They fall into two general classes: field exercises and simulations. A training setting usually consists of the following components which are either inherent in the training setting or determined by the user:

- A location or site at which training is conducted.
- Participants—trainees, evaluators, and OPFOR, or in battle simulation, a representation of OPFOR.
- A scenario
- Rules.
- A system for control of the exercise or simulation and casualty assessment.
- Means for performance measurement.
- Limitations.

The training management schedule brings trainees, evaluators or controllers, and OPFOR together in the setting selected for training. Scenarios describe the programs by which training is conducted and the actions of OPFOR, if a field exercise, or representations of actions of OPFOR, if a battle simulation.

Player tasks are derived from scenarios conducted within specific training settings. Tasks or activities interact with the training setting in that they may or may not be called for within any setting.

The role of rules is to model reality and to apply limitations on the capability of units to move, see, detect enemy, employ firepower, etc. An especially important set of rules pertains to rules of engagement between weapon systems. These take into account target vulnerability to each weapon and hit probabilities with range. Rules serve where actual physical limitations do not exist. Typically, rules must be more detailed and explicit in battle simulations where terrain and opposing forces are represented rather than being physically present. Rules enable the exercise or simulation to work as intended (e.g., SCOPES—keep your helmet cover clear).

The role of the control system is to enforce the rules, to safeguard participants, to input and control information to participants, to keep the exercise progressing, to represent (simulate) non-participating echelons or agencies, to effect casualty assessment, and, as appropriate, to interject or apply judgment and knowledge based on professional experience.

Performance measurement may be made by subjective evaluations, by exercise of rules to produce casualties, or by both methods. Subjective performance measures typically refer to the effectiveness with which an activity was conducted. T&E Outlines provide a means of rating performance as satisfactory or unsatisfactory. Casualties may be declared during the interactions of sides (in field exercises) or by manual or automatic exercise of rules of engagement in battle simulations. In battle simulations and in engagement simulation, casualty histories over time and casualty ratios provide the "bottom line" end product by which success is determined. However, reasons for success or failure usually need to be identified from process criteria as reflected in T&E Outlines and/or evaluator notes.

Limitations on tactical situations that can be depicted (for less obvious reasons than space or participants) are considered as defining factors of a training setting. For example, CAMMS accommodates operations within the limitation of non-nuclear environment. Where desired training situations cannot be represented, another training setting must be used.

2-2. SELECTION OF TRAINING SETTINGS

Training settings to be reviewed were selected using three major criteria:

- The setting must be relevant to the training of a battalion or its subelements: battalion staff, companies, platoons and leaders.

- The setting must be available to active Army units through normal distribution or procurement channels, part of the table of organization and equipment, available at post/division TASO, or obtainable by coordination with CATRADA.

- The setting must *not* be undergoing extensive modification, slated for modification, or being considered for deletion from the Army inventory.

Initial information about the different settings available and which ones met the criteria was obtained from ARI/Alexandria and the ARI/Fort Leavenworth Field Unit. An exception to these criteria was the ARI-developed Small Combat Unit Evaluation

game which was included since it is being used by ARI for research purposes. BATTLE was not included because we were unable to gain access to current documentation in time to meet reporting deadlines. MILES engagement simulation exercises were reviewed as engagement simulation-based field exercises, although MILES distribution is presently limited. Nine settings are described in detail in Annexes A through H.

2-3. TRAINING SETTING DESCRIPTIONS

Use of the above criteria resulted in selection of the following settings for study:

a. **Field Training Exercise (FTX).** A field training exercise can be for units of any size. Field training exercises for squads, platoons, companies, and the battalion are described in ARTEPs. Tasks, conditions and standards are provided in T&E Outlines. An OPFOR is selected, instructed and controlled so as to permit the unit being trained to exercise options typical of combat. Performance is evaluated by evaluators who will or may (depending on the rules in effect) declare casualties. Two-sided or integrated battalion field exercises have been run, but are not recommended.[7] Situations and scenarios are usually limited by safety and equipment or personnel constraints.

b. **Field Training Exercise With Engagement Simulation (FTX/ES).** A two-sided free-play field exercise, suitable for squad, platoon and company training. Rules are enforced by controller personnel. Casualties are generated from modified weapons hardware (SCOPES, REALTRAIN or MILES) during engagements. Personnel and equipment shortages and safety considerations limit situations that can be depicted.

c. **Tactical Exercise Without Troops (TEWT).** Primarily a field planning exercise conducted to analyze the application of tactical principles to terrain. A TEWT usually stops short of execution of the battle. It is conducted in the field for battalion staffs and company commanders and platoon leaders.

d. **Command Post Exercises (CPX).** CPXs represent the functions of a Tactical Operations Center (TOC) and, therefore, focus on battalion staff. Terrain is represented by topographic situation maps. Rules and the number of controllers depend on how the exercise is designed. Limitations stem from the ability of controllers to manipulate information.

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[7] ARI Technical Report TR-78-A26, Volume I, *op. cit.*, November 1978.

e. **The Combined Arms Tactical Training Simulator (CATTS),** located at Fort Leavenworth, Kansas, is essentially a computer-driven simulation for battalion commanders and staff. The computer serves the role of the platoons which are simulated. Orders of the battalion command group are exercised by personnel who serve as company commanders. CATTS maintains information as to location of every unit, unit strength, assets, movement rate depending on terrain and weather conditions, etc. The computer calculates line-of-sight intervisibilities and matches these with rules of engagement for weapons to assess casualties. The computer records battle actions and events and the time of their occurrence. Situations are limited to those programmed in the computer.

f. **The Computer-Assisted Map Maneuver System (CAMMS).** CAMMS is a computer-assisted battle simulation for battalions and brigade staffs. Terrain is represented by terrain boards. The battle is played on the board using symbols for units and weapon systems. The terminal is used to interact with a data base and is used as an accounting system to trade unit assets, logistics, and casualty assessments during engagements. Situations are limited by scenarios and data available in the computer data base.

g. **Pegasus.** Pegasus is, as both CATTS and CAMMS, a command group simulation for battalion and brigade level. Pegasus is entirely manual and all functions of casualty assessment, execution of orders, maintenance of strengths, status, and so forth are executed by the controllers. Situations are limited by the information processing and manipulation capabilities of the controllers.

h. **Dunn-Kempf.** Dunn-Kempf is a battle simulation for company commanders and platoon leaders to exercise tactics and maneuvers. Terrain is represented by a board. A screen is normally used to keep trainees on one side from seeing the deployments of the pieces on the opposing side. Control, engagements and casualty assessment procedures are handled manually. Situations are limited by information processing/manipulation capabilities of the controllers.

i. **The Small Combat Unit Evaluation Game (SCUE).** The SCUE was developed by the United States Army Research Institute. It has been used primarily as a research tool, but has been included in the current study for research purposes. It is for companies, platoons, squads, and fire teams. It has been used to replicate field exercises which have been conducted over the terrain which is represented in the simulation. It is manually controlled.

2-4. DEVELOPMENT AND DEFINITION OF TRAINING SETTING DIMENSIONS

A comprehensive frame was developed for analyzing training settings. The components of this framework had to meet two requirements. First, any parameter or dimension had to be applicable to all settings. Second, information from all dimensions taken together should provide a comprehensive description of each setting. Given these requirements, dimensions were defined and classified as follows.

First, the settings were viewed as descriptions of the environment that provide stimuli and information to players. Properties describing the environment were defined: means of terrain representation; physical properties of the setting such as size and equipment used; rules including rules of engagement, rules for movement, etc. These characteristics of the environment and stimuli were categorized as the training setting framework. Summarily, this framework describes the ability of the setting to represent combat situations and events. Specific parameters are listed and described in Figure 2-1.

A second perspective is oriented to the players—their roles, numbers and activities—as they are confronted with the environment and stimuli described above. The separate parameters deal with orientation of players, training objectives that can be played, functions and tasks of players and judged realism of the information presented to players or trainees. See Figure 2-2.

A number of dimensions were identified which together define the personnel and material resources required by each setting. These dimensions include requirements for controller training and operational cost items. In summary, they provide administrative requirements for each setting. See Figure 2-3.

A fourth cluster of parameters covers means used in each setting to describe performance and to provide feedback to trainees. One such parameter describes the extent to which evaluations are based on objective measures or on subjective judgments. Of special interest is the extent to which the setting provides the capability to maintain records of performance for use in critiques or after-action reviews. Here we describe the *capabilities inherent in the setting.* Actual practices may vary greatly among units. See Figure 2-4.

2-5. DATA COLLECTION

a. Documentation and Literature Review. Several methods were used to complete the descriptive matrix for each setting. Available research literature used to identify and define the critical dimensions of training was reviewed. CATRADA users' guides and descriptive pamphlets were surveyed. Pertinent field manuals provided information on the conduct of conventional field exercises.

FIGURE 2-1

TRAINING SETTING FRAMEWORK

Parameters	Description
1. Echelon and type units exercised.	Self-explanatory.
2. Special facilities/equipment.	Identifies facilities and devices associated with each.
3. Means of terrain representation	Describes how terrain information is presented to the player(s).
4. Means of representing weather and other impinging conditions	The extent to which effects of weather can be factored into the play. Other impinging conditions relate primarily to the play of smoke or other impediments to the ability of the units to detect the enemy, be detected.
5. Availiability of TOE weapon systems organic to unit	The extent to which firepower available to the unit can be represented in play and reflected in battle outcomes.
6. Availability of non-organic fire support	The extent to which indirect fire can be played and casualties from indirect fire can be assessed.
7. Rules governing movement (realistic constraints)	Representation of conditions which affect movement such as terrain, weather, and vehicle capabilities.
8. Rules of engagement for weapon systems (realistic constraints)	An integration of range, accuracy, target vulnerability, and any other conditions which must be applied to realistically portray the effects of each weapon.
9. Function(s) of computer	Self-explanatory.
10. Application of probability	How probability is introduced to represent variance in hits and kills during engagements.
11. Extent to which scenario can be manipulated/modified to accomplish training objectives	Limitations placed on scenario manipulation by the training setting. Limitations pertain to the scope of missions and training objectives that can be represented in planning exercises. Limitations refer also to the ability to manipulate the scenario on an *ad hoc* basis during the course of the mission.
12. Capability to halt play or replay events	Self-explanatory.

FIGURE 2-1 (Continued)

Parameters	Description
13. Capability to adjust level of difficulty	Level of difficulty is largely scenario dependent. Interest is in this capability to adjust the scenario so that the training setting can be adapted to knowledge/skills of players during progressive training.
14. Opposing force organization	The capability provided to manipulate the workers, mobility, firepower, and other relevant parameters of opposing forces.

FIGURE 2-2

FUNCTIONS AND DUTIES OF PLAYERS

Parameters	Description
15. Number and roles of players	Self-explanatory.
16. Positions with which players interact	Describes interactions among players and the interaction between players and controllers.
17. Training objectives that can be accomplished	What missions can be played and the extent to which training objectives inherent in each mission can be evaluated in the play of the scenario.
18. Unit/Command group functions	What command group tasks (Chapter 10 of ARTEP 71-2) are playable and observable within the setting
19. Realism of information and feedback available to players in terms of amount, speed, and accuracy	This item is particulary relevant to information available to players from simulations, and how perceived.
20. Requirement for player orientation to training setting	Amount of time devoted to explanation of the training setting and how players are expected to perform.
21. Susceptibility of setting to "gamesmanship"	Player's ability to know and understand how easy it is to manipulate rules of a setting to his advantage in an unrealistic manner. The extent to which the settings permit players to use characteristics of settings to their advantage in ways they could not employ in combat.
22. Existence of constraints or required procedures which are peculiar to setting (i.e. unrealistic features).	Potentially unrealistic activities or procedures required of players or limitation on the training setting to portray a full array of possible outcomes.

FIGURE 2-3

REQUIREMENTS FOR ADMINISTRATION

Parameters	Description
23. Number of controllers, positions played by each	One of the man-hour cost elements. Positions played by controllers indicate expertise required of them.
24. Number of aggressor and auxiliaries	The number of individuals required to represent the opposing force. Auxiliaries are administrative support personnel. For example, in field exercises, ammunition handlers or vehicle drivers; in simulations, personnel to maintain data files, make compensations.
25. Requirements for training controllers, auxiliaries (time, special skills)	Cost element in terms of man-hours. Focuses on the training required for controllers to function properly.
26. Duration of exercise	Self-explanatory.
27. Means for applying rules of engagement, casualty assessment	The tasks required of controllers and auxiliaries and the administrative burden of controlling engagements and assessing casualties.
28. Provision/means for recording player responses (including commo)	The amount and types of information that can be collected during the exercise for subsequent review to analyse performance.
29. Operational costs	• Number of controllers in support of the exercise. Exercise support personnel times the duration of the exercise. • Number of controllers times the duration of the controller training, to include training personnel to train controllers. • Number of personnel required to set up the equipment and facilities for the training setting times the time required. • Incidental or identifiable dollar cost elements such as in the case of CAMMS where a computer time is required, the hourly rate times the average exercise duration.
30. Set-up time	The number of personnel required to set up the necessary equipment and amount of time required.

FIGURE 2-4
MEASUREMENT, EVALUATION, AND FEEDBACK

Parameters	Description
31. Means for rating performance (how and when)	Performance measure/rating systems included or prescribed with the training setting. How and when data are collected and assembled.
32. Positions rated by each controller (background requirements)	The span of controller observations. Expertise required of particular controllers in order to be able to observe and rate players and maintain records.
33. Objectivity of performance indicators/ ratings	Extent to which outcomes are produced by objective measures or dependent on subjective judgements by controller/evaluators. The impartiality and consistency with which outcomes or ratings would be generated.
34. Diagnostic capability (overall)	Amount of information and degree of resolution about individual or group performance and the extent to which information obtained is sufficient for planning of remedial training.
35. Opportunity/provision for critique/ instruction	Extent to which feedback is provided, either during or after the completion of the exercise; the nature of the feedback commonly provided.

Review of the available research literature and guidance documents provided general information about each setting. However, the specificity of many dimensions required more detailed information than the publications could provide. In many cases, the documentation caused more questions to be asked than it originally answered. Arrangements were made through ARI for HSR to visit CATRADA, Fort Leavenworth, and interview the proponents of each simulation setting. Personnel of the ARI/Fort Leavenworth field office made available reports of past research on alternative training settings and contributed to discussions.

b. **Field Trips.** HSR personnel accompanied by ARI personnel traveled to Fort Leavenworth, Kansas. Interviews were conducted with representatives of the proponent offices for CATTS, CAMMS, Pegasus, and Dunn-Kempf within the Combined Arms Training Development Activity of the Combined Arms Center. Extensive discussions were held with ARI/Fort Leavenworth field office personnel who had conducted research with CATTS, investigating its applicability to ARTEP missions and tasks.[8] Interviews were conducted in group format where HSR personnel queried the group about information pertaining to each of the 35 features in the matrix. Interviews were taped for further later review by HSR. A CATTS exercise was also observed.

In September, 1978, HSR personnel traveled to Fort Pickett, Virginia, and observed a weekend CAMMS exercise administered by the 80th Division Maneuver Training Command. Data for each feature was obtained by observation and post-exercise interviews with exercise controllers. Comments were also solicited from 80th MTC Personnel about Pegasus, which they had used extensively.

HSR's previous experience in observing battalion field exercises during project phase one, and platoon exercises during project phase two provided additional information for descriptions of field exercises.

HSR's past observations and experiences in engagement simulation (ES) exercises were also used to fill needs for data in the FTX/ES setting.

Several HSR personnel contributed information in group meetings held with the same format as interviews held in CATRADA.

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[8]Ira Kaplan and Herbert F. Barber. *Battalion Command Group Performance in Simulated Combat.* Technical Paper, Army Research Institute for the Behavioral and Social Sciences, Alexandria, Virginia.

c. **Diagnosis of Training Needs.** Training needs may be identified in a number of ways. Among these are reviews of performance of elements on prior field tests or during simulations, knowledge of qualifications and experience of key individuals, and review of such other prior records of training as may be available. This information can be assembled for battalion elements to indicate the levels at which training is most apt to be needed (battalion command/staff, company, platoon, squad), to identify leaders and units who most need training, and, within missions usual to battalions and their elements, to better define training content.

During this diagnosis, it may be possible to make intelligent guesses as to whether the most critical needs pertain to the planning of missions and transmissions of orders, or to practice in mission execution once mission orders are given. While good planning does not necessarily lead to effective execution, it helps. A key issue here is the extent to which leaders, working from orders from above, have sufficient appreciation of tactics to develop mission plans that take full account of their own unit capabilities and possibilities for outside support, intelligence about the enemy, and knowledge of the ground. For training purposes, if it is possible to separate probable training needs in tactics and planning from needs in practice and execution of missions, settings can be selected that are most appropriate for each of these areas. Review of prior performance as indicated by ARTEP mission outlines can provide pertinent information and better help to target need areas. The distinction between planning and execution is also important in that a poorly conceived mission plan will often lead to needless problems and foulups in mission execution.

Another important consideration bears on whether battalion elements have had an opportunity to work together as integral teams. If they have not, a logical important training objective would be to stress inter-unit coordination and to assure practice in transmission of orders, transmission of intelligence, and interunit communications. Frequent comments from Army evaluators observing battalion field exercises were that battalion elements were not keeping each other informed, and that leaders at company and platoon levels were not exercising sufficient supervision.

Obviously, results of the diagnosis of training needs should be made known to evaluator/controllers and stressed when these personnel are being indoctrinated and trained in preparation for conduct of exercises and/or simulations.

d. **Training Settings as Options.** The nine settings described in Annexes A-I, represent optional means of training available to brigade and battalion commanders, operations officers, and others who plan and supervise training. In practice, these options are reduced substantially by identification of echelons at which training is most needed and by information or educated guesses as to training content

2-6. TRAINING SETTING NARRATIVE DESCRIPTIONS

Data collected from the group interviews at CATRADA, HSR and ARI/Alexandria were analyzed and summarized in a narrative describing each training setting on each of the 35 dimensions. After completion, the narrative summaries for CATTS, CAMMS, Pegasus, and Dunn-Kempf were forwarded to CATRADA, Fort Leavenworth, for review and comment on comprehensiveness, clarity and consistency. FTS, FTX/ES, CPX, and TEWT were reviewed internally by HSR staff. The SCUES narrative was reviewed by ARI/Alexandria. Review comments were incorporated into final narrative descriptions of each setting. The completed narratives appear in Annexes A-I.

2-7. COMPARISONS OF SETTINGS

The material to follow compares training settings in groups and by individual settings. These comparisons are based on descriptions of settings in material produced by the Army and ARI research reports and observations of training in these settings.

CHAPTER 3

COMPARISON OF TRAINING SETTINGS

3-1. INTRODUCTION

This chapter classifies training settings into groups, then makes comparisons between groups of settings in terms of what appear to be their strong points and applications to collective training. Comparisons are made, in turn, between:

- Field exercises as a group and battle simulations. Exercises and simulations are compared at battalion and company levels.
- Conventional field exercises as set forth in ARTEP and Engagement Simulation (REALTRAIN and MILES).
- Types of battle simulations: CATTS, CAMMS, Pegasus, Dunn-Kempf, and CPX.

Chapter 4 uses this material as a basis for conclusions and recommendations.

a. Importance of Planning and Thoughtful Conduct of Training. Substantial evidence can be cited to show that any of the nine settings described can have substantial training value. However, selection of an appropriate training setting cannot guarantee that effective training will occur. The value of training in any setting depends in large part on how well training is planned and the care with which training is conducted. Nonetheless, all settings have advantages and limitations. Some settings, properly exploited, are better adapted to certain types of training for specific battalion elements than others. Some settings are more appropriate to some stages of training than to others. The material to follow points up these "margins of advantage" or disadvantage.

b. The Battalion Field Exercise as Focal. Collective training programs are continuous through time. While the Army has moved away from the progressive cycle of training practiced until a few years ago, battalion field exercises are conducted periodically. In this report, taking battalion field exercises as a point of departure, two questions can be asked: How may training be structured in preparation for these exercises? Or, how can results from battalion field exercises be used to assist the planning and structuring of future training? These questions derive from our Phase I study. Answers to these questions can help to fit battalion field exercises into a brigade or division training schedule.

that should receive greatest emphasis. Options may be narrowed still further by availability of resources, but this will depend on locales. Still, certain choices between settings remain. Considerations that bear on these choices are developed in the rest of this chapter. Comparison of nine settings, each with one another, to yield some 36 comparisons would be unwieldy. Instead, settings are divided into two clusters: field exercises and battle simulations. Comparisons are then made between and within clusters.

Field exercises consist of:

- conventional ARTEP missions, and
- engagement simulation.

Battle simulations consist of:

- battalion command/staff level–CATTS, CAMMS, and Pegasus,
- company/platoon level–Dunn-Kempf and SCUE, and
- any level–CPXs, really quasi-simulations.

The narrative descriptions in Annexes A through I provided the raw data for comparisons. In many instances, items from the list of 36 are combined to make comparisons clearer and call attention to key issues.

3.2. FIELD EXERCISES COMPARED WITH SIMULATIONS

a. Introduction. A general distinction between field exercises and simulations is that simulations are intended for leaders or for leaders and staff. Field exercises are designed for entire units. While leaders are involved in both forms of training, simulations are oriented to training a few leaders at selected command levels. Troops are not involved. More specific comparisons are made in Figure 3-1. To the extent to which the features described in Figure 3-1 are not common, the same knowledges/skills cannot be practiced in both types of settings.

b. Battalion Field Exercises Compared with Simulations. Figure 3-1 sets forth some eighteen items by which ARTEP battalion field exercises are compared with simulations designed to train battalion staffs. In making these comparisons, we are concerned primarily with conventional exercises rather than engagement simulation. Current development of the MILES system stands to make the play of full battalions in engagement simulation exercises possible. This is a prime objective of the National Training Center.

FIGURE 3-1

BATTALION FIELD EXERCISES COMPARED WITH BATTLE SIMULATIONS AS TRAINING VEHICLES

Item for Comparison	ARTEP–FEX	Battle Simulation (CATTS, CAMMS, Pegasus)
1. Requirements for maneuvers: area, space	Must be scheduled along with needs of other units. Often space limited for combined arms maneuvers.	No space problems. However, simulations require competent staff for administration. CATTS especially needs expertise.
2. Time/resources required to prepare for training	Very substantial time/resources required.	Vary with simulations. Least with CATTS with professional staff to run.
3. Number, variety of missions that can be played	Missions requiring extensive maneuvers may be terrain limited. See also Item 7.	Any mission can be assigned; mostly, play has consisted of attack, defense, covering force operations.
4. Play of duties of staff members. Ability to tailor information inputs and stimuli requiring action to duties, responsibilities of specific staff members	Can be done to some extent. Often duties of S-1, S-4 have not been adequately exercised.	Can readily vary scenario inputs to vary tasks, task loads of staff members, and requirements for staff coordination.
5. Play of rules of engagement	Very difficult to play exchanges of fire realistically, in timely manner.	Can be played by computers (CATTS) or controllers (CAMMS, Pegasus).
6. Simulation of Warsaw Pact weaponry, tactics	In concept can be simulated but very expensive to do so. Time-consuming to train an OPFOR to use Warsaw Pact tactics.	Can be readily simulated. Requires only that OPFOR controllers be indoctrinated in OPFOR tactics.

Item for Comparison	ARTEP–FEX	Battle Simulation (CATTS, CAMMS, Pegasus)
7. Realistic play of defense mission, forced withdrawals	Extremely costly to simulate force ratios realistically.	Can readily simulate any desired size of OPFOR.
8. Play of EW/counter-EW	Can be played within capabilities of equipment. May create security problem, radio interference problems.	Can be developed in simulation.
9. Play of air, organic and non-organic artillery, mines, barriers, chemicals	Effects can be made apparent to staff and commanders by controller input, but difficult and labor-intensive to provide simulation on the ground.	All can be accomplished readily in simulation.
10. Realistic play of casualties; casualty assessment	Can be played, but close coordination of OPFOR weapon signatures needed for realism.	Can readily be played. Questions arise as to validity.
11. Ability to introduce problems created by human failure, mechanical breakdown, commo failures	These interject themselves frequently without plan/ intent.	Problems and effects can be simulated. Questions arise as to validity.
12. Constraints introduced by safety regulations as impediments	Difficult to realistically use live fire. Expensive.	None
13. Ability to provide experience in management of a four-echelon organization.	A necessary component of battalion field exercises.	Can be simulated for battalion staffs with company commanders degrading inputs.

Item for Comparison	ARTEP–FEX	Battle Simulation (CATTS, CAMMS, Pegasus)
14. Opportunity to practice and reinforce discipline in the field and to supervise execution of tasks, correct errors	Should be a key element of battalion field exercises. However, often in practice opportunity not fully exploited.	Not realistically.
15. Capability of evaluators to detect errors, oversights, and miscommunications	Highly dependent on evaluator training. Evaluators must work as team.	Can be much more readily done than in field exercises since only one command echelon is involved.
16. Ability to critique performance at regular intervals and to adjust frequency of critiques to performance of units	Normally one critique has been given on completion of exercises. More frequent critiques recommended.	Can readily critique at desired intervals. CATTS has reset and replay capabilities.
17. Efficiency of use of training time	Difficult to provide all platoons, squads opportunity to cover most of their combat-relevant duties.	Provides opportunity for very effective use of training time of commander, staff.
18. Costs of training	Very expensive training.	See annexes: CATTS; CAMMS, Pegasus.

When information about the two forms of training—field exercises and battle simulations—are shown side by side, the superiority of battle simulation for training battalion commanders and members of the battalion staff seems clear and compelling. A few items warrant special comment.

(1) Maneuver area; time resource requirements (Items 1, 2). Requirements for maneuver areas and time, and resources required for preparations are much less for simulations. As weapons increase in lethality and range, and if dispersion recommended by doctrine continues to increase, it will become increasingly difficult in the future to conduct battalion-level exercises on the space available on some military reservations.

(2) Rules of engagement; casualty assessment (Items 5, 10). Rules of engagement are very difficult and complex to play realistically in conventional battalion field exercises. Realistically, the training of evaluator/controllers that would be needed to do so would likely far exceed the time that could be provided by operational units. Reportedly, matching weapons capabilities against targets differing in vulnerability was a problem as CATTS was being developed, a problem that has now been surmounted. It is assumed that intervisibilities are validly estimated and casualties properly declared in CAMMS and Pegasus.

(3) OPFOR capabilities; force rations, electronic warfare (EW) (Items 6, 7, 8). It is noteworthy that field exercises cannot provide, or can provide only with great difficulty, some forms of information inputs that a battalion staff would have to deal with in battle. Warsaw Pact weaponry and tactics, practice in defense missions, play of EW, and substantial enemy air strikes fall in this category.

(4) Performance observation and critique (Items 15, 16). Since the simulation addresses only one level of command, it is much easier in battle simulations to detect errors and oversights of trainees. Certain errors in control/communications can be especially difficult to trace to their sources in field exercises where errors made at one level or station can cascade through the system.

Simulations have the further advantage that critiques can readily be given after each mission. It has been recommended that provision be made for at least some critiques during a battalion three-day exercise. Admittedly, these might be difficult to schedule and manage. The alternative, however, is to allow men being trained to repeat errors, and in doing so, to learn and reinforce incorrect behavior and/or fail to take certain important actions such as supervision of subordinates and reporting intelligence.

(5) Management and supervision potential (Items 13, 14). The superiority of battalion field exercises over simulations lies in their ability to provide all leaders experience in working within a four-echelon organization. Field exercises

potentially provide leaders at all levels opportunities to convert orders into plans and to practice troop leading procedures. The discipline developed throughout the unit by practice in doing these things, and the development of mutual expectations between elements that must coordinate their activities stand as strong arguments for conduct of battalion exercises for training. However, three recommendations are worthy of note:

(a) The battalion field exercise, so expensive to conduct, has not fully exploited the opportunities for leader training unique to this setting. Often these exercises were conducted on a predetermined and inflexible time schedule which tried to include as many missions as possible in the three days in the field. The result, frequently, was that junior leaders did not have time to fully practice troop leading procedures.

(b) The problem of failure to fully exploit the opportunity for training that a battalion field exercise can provide arises in a different form if the battalion staff, unpracticed in working together, takes an unnecessarily long time to convert orders from (simulated) brigade to orders to lower echelons. The time required to do this is substantial, even with a professional staff practices in working together. As time is unnecessarily extended, lower level personnel, who can only act after orders are given, must wait around for unnecessarily long periods of time. This contradicts the principle of gainfully using training time for all echelons.

(c) The role of peers at company and platoon levels in acting intelligently on their own, thus unburdening leaders, is often not fully exploited in field exercises. In planning unit training, communications up and down levels of command obviously need stress. But it is easy to overlook the importance of lateral communications. Surprise is characteristic of combat. All enemy initiatives cannot be foreseen in advance. Unlike simulation, field exercises permit peers to assist each other in responding to many situations not fully anticipated in mission orders. The critical importance of communications on the battlefield was stressed by S.L.A. Marshall in accounts of World War II battles.[9] Field exercises provide many occasions for practice of laternal communications.

(6) Battalion staff as information handlers; similarity to combat jobs. Battalion commanders and staff are essentially information processors and decision-makers. With occasional exceptions (personal reconnaissance, etc.), they react to and process information *about* units, activities, and events. They do essentially the same jobs in combat. We would expect that the simulations conducted for the battalion staffs are more realistic to combat jobs, hence, provide better opportunity for transfer learning than do simulations at company and platoon levels such as Dunn-Kempf.

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[9]S. L. A. Marshall. *Men Against Fire—The Problem of Battle Command in Future War*. Infantry Journal Press, Washington, D.C.: 1947.

(7) Summary. Simulations for battalion commanders and staff personnel serve as an excellent vehicle for training. From a cost viewpoint, it is much easier to generate information *about* events than to bring about conditions such that events will occur and be reported. As the state-of-the-art in simulation and information transfer continues to grow, simulations stand to become still better methods of training.

c. **Company Level Exercises Compared with Simulations.** A full array of ARTEP missions and T&E Outlines is available for training combined arms companies, platoons, and squads. Problems of effective management of field exercises are present whatever the size of units being trained. Nonetheless, as we work down the command chain from companies to platoons and squads, it becomes increasingly easier to manage training so that personnel at all echelons are provided opportunities to practice their combat-relevant options and choices. Requirements for training areas are reduced, as is the time lower echelon elements must wait for leaders to go through their troop leading procedures and issue orders. It is then reasonable to expect that companies, platoons, and squads can be provided more training in exercises tailored to lower echelons than they will receive as participants in battalion field exercises. Thus, field exercises for lower echelon units can more profitably use training time. Here, the play of the rules of engagement in engagement simulation field exercises clearly demonstrates the consequences of careless or improper actions on the battlefield, concurrently stimulating interest and motivation of leaders and troops. Further, the comparative advantage of field exercises at company and platoon levels to simulation for these levels is further enhanced by greater dissimilarities between tasks practiced in current simulations and total task requirements of squad, platoon, and company leaders in combat.

Several forms of battle simulation can be used to train company and platoon leaders: Dunn-Kempf, CPXs, TEWT, and SCUE. Taking Dunn-Kempf as an example and comparing it with field exercises, it would appear that comparisons between company and platoon field exercises and simulations would be similar to those for battalions, however, there is a most important exception. This alone, to some degree, degrades the comparative advantages of simulations at company and platoon levels.

The battalion commanders and staff work basically in an information medium. They are information processors. By contrast, company and platoon leaders operate in a mixed medium. That is, they give orders and receive reports, but they are also exposed and respond to the sights and sounds of battle. This is especially true of platoon leaders who, when feasible, will communicate with subordinates face-to-face and by hand-and-arm signals. The company commander must shift media frequently. Also, since he has no staff, he must create his own displays using such maps and sketches as he has available. Often, depending on vegetation, terrain, etc., he will not be able to see many of his own forces, so he must store a good deal of information in his head. From this perspective,

Dunn-Kempf, which permits leaders to see their own forces on the board, unrealistically unburdens commanders at company and platoon levels. Further, problems introduced by faulty communications and errors by subordinates–Von Clausewitz combat *frictions*[10]–cannot be readily interjected.

We believe that the above factors combined limit the value of Dunn-Kempf and simulations designed for training company level leaders. Simulations can, however, likely serve useful functions in teaching tactics and procedures and in providing insights into problems of coordination of activities of subordinate elements.

3-3. COMPARISON OF APPROACHES TO CONDUCT OF FIELD EXERCISES

a. Introduction. Current doctrinal methods of conducting field exercises are described in ARTEP documents which contain T&E Outlines for all elements from squad to battalion levels. In the last several years, Training Systems ManagerTactical Engagement Simulation (TSM-TES), ARI and contractors have pioneered the development of a second method for training of tactical elements–engagement simulation. (Engagement simulation [ES] takes two forms: a manual system REALTRAIN, and a system built around lasers/sensors–MILES.) The two approaches–referred to here as conventional and ES exercises–are described in Annexes A and B. A discussion of similarities and differences between these two methods and considerations involved in their integration is reported on elsewhere.[11] This report describes considerations training managers may wish to take into account in selecting either or both conventional ARTEP missions or engagement simulation (ES) as vehicles for training. As developed below, these two approaches or methods–conventional training and engagement simulation–are best regarded as complementary rather than as competitive.

b. Engagement Simulation Still Being Developed. As described in separate reports, *The Development of Engagement Simulation-Based ARTEPs*, engagement simulation using controllers to verify target hits and activate signatures of weapons has been proven to be an effective training vehicle. However, because in the manual system (REALTRAIN) controllers can only use a single channel to communicate/confirm target

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[10] Karl Von Clausewitz, *On War*, Chapter 7, Book I. The Modern Library: 1943. Pages 53-55.

[11] *The Development of Engagement Simulation-Based ARTEPs*, Technical Report. Human Sciences Research, Inc., McLean, Virginia: 5 December 1978. *Improved Army Training and Evaluation Programs (ARTEP) Methods for Unit Evaluation–Volume VI, Conventional ARTEP Missions and Engagement Simulations: An Examination of Options.* Final Technical Report. Human Sciences Research, Inc., McLean, Virginia: 30 April 1979.

hits, REALTRAIN cannot be used for mechanized infantry units larger than companies. Applications of ES using MILES (Multiple Integrated Laser Engagement System) are still being developed along with prototype doctrinal material. The REALTRAIN approach is further along in developmental stages. It has been implemented by a few operational units without outside assistance. MILES has not. The comparisons between conventional methods and ES–both REALTRAIN and MILES–that follow are based on the most current information available to us at this time. As ES is further developed, it will become possible to further verify these comparisons.

c. ARTEP *Conventional Missions and Engagement Simulation Compared.*

(1) Summary descriptions. ARTEPs have been developed to address training needs in prolonged peacetime environment rather than in a mobilization environment. ARTEP 71-2 includes usual missions for all mechanized infantry units from squad to battalion levels. Its T&E Outlines assume a progression of activities from initiation of missions to their completion. An instructed OPFOR provides opposition so as to test the unit in accomplishment of training objectives within mission contexts. The senior evaluator acts as the commander of the next higher unit. Evaluators, using T&E Outlines, grade performance as "satisfactory" or "unsatisfactory." Mission performance is scored by integration of ratings on T&EO items.

(2) Engagement simulation is a two-sided, free-play exercise. Units with conflicting missions are joined in simulated battle. In REALTRAIN, casualties are declared as they occur by controllers who inform controllers on target vehicles of the opposing side that a hit has occurred. A Net Control Station (NCS) keeps a record of the identity of each casualty through time. In MILES, casualties are determined automatically by laser-laser detector equipment which takes into account range and the vulnerability of the target to the weapon that fired on it, as casualties are assessed. Casualty records are maintained by a Net Control Station (NCS). The winner of the battle is determined by casualties inflicted or received by the two sides.

After battle, controllers on each side are assembled and casualty records are reviewed to confirm the validity of records. Next, an After-Action Review (AAR) is held in which both sides praticipate. Errors, omissions, and effective actions are brought to light in discussions between the senior evaluator and players of opposing sides who inflicted/suffered casualties.

(3) As engagement simulation has developed, a vocabulary slightly different from that used in ARTEP has emerged.

- Control is emphasized so trainers are referred to as "controllers" rather than evaluators.
- A debriefing is held after each mission for controllers only.

- The post-mission discussion with participants is referred to as an After-Action Review (AAR) rather than as a critique.

d. **Comparison of Methods.** Figure 3-2 compares the two methods with regard to major differences among them. A brief discussion of items follows.

(1) Plans/Preparations. Time required for plans and preparations of exercises by the two methods are roughly comparable. There is this difference: poor planning and evaluator training is less obvious when conventional exercises are run. If ES planning is inadequate, this is readily obvious to trainees and controllers when they attempt to use ES as a training vehicle. The reasons are not obvious to the reader at this point. See item below of Rules of Engagement (ROE).

(2) Equipment. REALTRAIN and MILES do require the operation and good maintenance of added equipment. Particulars are documented in Annex B.

(3) Exercise of ROE. Conventional training does not attempt to depict the precise interactions between sides that call for accurate and timely assessment of casualties. ES does. This is necessarily the focus of many preparations for ES exercises.

(4) Capability for establishing/implementing training objectives.

(a) Mission planning/giving orders. Here, the conventional approach provides more direct observations and evaluations. While evaluator ratings carry a substantial subjective component, observations of the process (activities of units) are direct. For example, ES in its pure form would require *inferences* as to the efficiency of mission plans from the outcome of the engagement. While such inferences can be drawn, (possible) errors in planning and issuing orders must be ferreted out from (possible) errors in *execution* of orders. This is often not an easy task.

(b) Mission execution. The more mechanistic conventional approach with directed OPFOR play may be more adaptable to coverage of specific training objectives. To the extent that ES gives each side freedom, it is somewhat more difficult to tailor it to specific training objectives. This depends in part on the substance of the objectives themselves. For example, objectives bearing on terrain appreciation, weapons engagements, etc., can usually be realized more effectively by ES than by conventional methods, even when complete freedom between sides is allowed.

(5) Permitting innovative solutions. The payoff for conventional exercises is gained by following routines prescribed beforehand and coded in T&EO items. Since the items are predetermined, the prescribed behaviors are predetermined as well. ES often

FIGURE 3-2

ES AND ARTEP COMPARATIVE PARAMETERS

ITEM	ARTEP T&EO MISSIONS	ENGAGEMENT SIMULATION
Plans, preparations*	Involves initial plans and training evaluators, instruction of OPFOR. Requires substantial time.	Involves initial plans, training controllers, assembly of equipment. Requires time, care.
Equipment Requirements	Equipment organic to unit only.	See Annex B.
Missions That Can Be Played	All missions.	All missions involving enemy contact.
Exercise of ROE for Defensive Weapons*	Very difficult to make realistic, to realistically represent interactions between sides. Typically arbitrary, unrealistic.	Built into manner of execution: • Controller equipment/training if REALTRAIN. • Lasers/sensors if MILES
Permitting Innovations in Tactics, Creative Solutions*	Checklists tend to encourage by-the-numbers execution by pre-arranged schedules.	Creates environment in which both sides can exercise engenuity. Often calls attention to valuable training objectives not in scenario plan.
Capability to Establish and Implement Training Objectives	Can readily be established for all missions. Controlled by orders, OPFOR play.	This area being explored. In general, the greater the scope of free-play, the more difficult to plan training to fit pre-established objectives.
Recording/Evaluation of Performance	Recording/evaluation by ratings of evaluators using T&E checklists.	See Annex B for descriptions of how performance is recorded for REALTRAIN, MILES.
Integration of Information for Diagnosis and to Score Outcomes	Ratings are combined by simple addition or such means as evaluators contrive. Outcome is sum of ratings.	Outcome information is available in the form of casualty histories over time, casualty ratios. Events/diagnosis performed through After-Action Review (AAR) with players on each side.
Conduct of Critique or After-Action Review (AAR)	Practices differ. In some instances often as highly condensed summary.	Practices recommended involve bringing both sides (or leaders of both sides if company or larger) together, reviewing events, encouraging between-group dialog.
Troop Acceptance, Motivation to Participate	Varies from case to case. Often considered "just another terrain ride."	The rules of the game, when applied as prescribed have produced competitive atmosphere with high troop motivation.

brings to light important training points that were not anticipated in exercise planning. This does, however, place a burden on controllers to recognize and interpret these so they can be brought out in the AAR.

(6) Recording/evaluation of performance; integration of information. Evaluations by conventional methods is entirely dependent on evaluator judgments. Typically, evaluation is performed by summation of scores on pre-established T&EO rating items. This means that evaluators must be well trained. ES uses a different method: it begins with product criteria-casualty histories over time by developing the behaviors on each side that led to the casualties. A record of unit positions through time can provide assistance. Thus, conventional methods sum process criteria. ES starts with product criteria and infers performance in terms of processes-actions of both sides. Provisions for controller debriefs and AARs encourage inputs from all participants to this inferential process. While more demanding, ES should provide substantially more combat-relevant and valid evaluations of those actions of each side that pertain to success in the conduct of the battle.

(7) Conduct of critiques and AARs. Learning theory strongly suggests that when the ES AAR is conducted as prescribed, the personal involvement it elicits by bringing participants into the discussion is conducive to learning. Field observations confirm this.[12] It would help, we think, to hold the critique after conventional exercises in the same manner. This is often more difficult since trainees accustomed to traditional methods are more likely to think of their role during critiques as that answering criticisms, rather than contributing to discussions. This mode of thinking can readily make it difficult to train those who are accustomed to current practices in holding critiques to hold effective AARs after engagement simulation. A key point for training managers to note.

(8) Troop acceptance/motivation. It has been repeatedly demonstrated that when well-planned, ES has produced excellent troop motivation.[13] The factors that encourage this are built into the way in which the exercise is managed and AARs are held. This is not to say that enthusiasm *cannot* be generated in conventional exercises. But managers need to work harder at it.

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[12]R. T. Root, K. I. Epstein, F. H. Steinheiser, J. F. Hayes, S. E. Wood, R. H. Sulzen, G. G. Burgess, A. Mirabella, D. E. Erwin, E. Johnson, *Initial Validation of REALTRAIN with Army Combat Units in Europe*, ARI Research Report 1191, October 1976, pages VI, VII.

[13]John J. Bosley, Peter W. J. Onoszko, Exequiel R. Sevilla, Jr., *The AAR Leader Role in REALTRAIN–Research on Training Needs*, Human Sciences Research, Inc., McLean, Virginia: June 1978.

(9) Overhead costs associated with one-sided versus two-sided play of engagements. Either conventional exercises or engagement simulation can be played as one-sided —a unit in training opposing a controlled OPFOR—or a two-sided exercise in which both sides are given freedom. While local practices differ, in conventional field exercises OPFOR is thought of as the foil for the unit being trained. Thus, the OPFOR receives little training. As such, it represents an overhead cost. If, instead, in conventional exercises, the OPFOR is given freedom, the tasks of control and evaluation become much more difficult. Conventional field exercises do not provide the means of handling these tasks effectively.

While ES can be played with a controlled OPFOR, we think the arguments are for giving both sides freedom in almost all training applications. The reason is that if ES is played one-sided, personnel required for an ES OPFOR must be added to controllers and ES equipment, thus, substantially increasing overhead costs of training. A controlled OPFOR, equipment costs, and controllers all added together make for a substantial overhead burden.

e. Conclusions. We find engagement simulation—currently under development—as a means of training for the battle attractive on many counts. These are cited earlier and in our report on the ES ARTEP. Among issues yet to be resolved are the following:

- Whether ES is to be used to replace conventional methods of unit training or to complement them. Training in those activities that precede the battle, in battle drill, in reconnaissance patrols, etc., can perhaps be given almost as well by conventional methods. This argues, we think, for ES as a complement to conventional methods.

- Whether ES can handle home station training for battalion-sized units. MILES equipment would be required.

- Costs and effectiveness of ES training as compared with conventional training. This would include personnel costs and costs of operating and maintaining equipment.

Finally, it is worth emphasis that ES is a much more refined training tool. This means that to exploit its capabilities well, careful prior planning is required and the chief controller and his team must be well-trained and practiced. Training of controllers must stress and provide practice in:

- Accurate assessment of casualties and communicating these to controllers on the other side (REALTRAIN).

- Comprehensive coverage of events in the controller debrief as to how the exercise went, and sources of errors and effective performance.

- Holding the AAR to gain participation of all, thus getting participants ego-involved and helping them to learn and remember.

3-4. COMPARISON OF BATTLE SIMULATION TRAINING SETTINGS

a. **Introduction.** There are two subsets of battle simulations: those for battalion and higher command/staff elements (CATTS, CAMMS and Pegasus); and those for company, platoon and squad levels (Dunn-Kempf and SCUE). These subsets are addressed separately. Command Post Exercises (CPXs) are included as an additional alternative, since they can approximate battle simulation. CPXs will not be addressed in each subset, since their strengths and weaknesses are independent of echelon.

b. **Battalion-Level Battle Simulations.** Battalion staffs are principally information processors and producers. The preponderance of their knowledge of the events of the battlefield comes as fragmentary reports from secondary sources. Their information is never complete; it is apt to be inaccurate, and it lags the events reported. Staff functions in this information processing mode call for cognitive skills and close teamwork between staff members. For these reasons, battle simulations are especially appropriate for training the battalion staff. According to the proponent agency for battle simulations, their design objective was to provide cost-effective options for the training of command/ staff groups.[14]

Fundamentally, all three battalion-level simulations–CATTS, CAMMS, Pegasus–are quite similar. All exercise the major battalion functions of command/ control, intelligence, fire support and maneuver. All were designed to represent command group tasks outlined in ARTEPs 100-1 and 71-2. CATTS, in particular, covers comprehensively command/staff tasks and subtasks.[15] They can be considered equivalent in scope of coverage. Player and controller organizations are comparable, though both may vary in number of personnel involved.

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[14]"Battle Simulations and the ARTEP," Army Training Support Center Bulletin No. 78-4, Fort Eustis, Virginia: November 1978.

[15]Ira T. Kaplan and Herbert F. Barber, *op. cit.*

The settings vary on two main dimensions: degree of automation and degree of centralized control. Strengths and weaknesses can be traced back to one or the other of these dimensions.

(1) Degree of centralized control.

(a) Planning and preparation required. CATTS is a fully centralized system installed at Fort Leavenworth. All players go on temporary duty to use CATTS. All control personnel are permanently assigned to CATRADA. Thus, local unit training managers are not responsible for either controller selection or training.[16]

CAMMS is exportable from CATRADA. Normally, a traveling team from CATRADA will conduct controller training. The training manager must select controllers and auxiliary personnel.

By contrast, with Pegasus and CPX settings, the training manager is responsible for selection of controllers and conduct of controller training. Pegasus has a fully-developed instructional package, but requires local talent to man the control system. With CPXs, the training manager is also responsible for controller training. Both Pegasus and CPX require substantial amounts of staff time to prepare for training. Thus, from the standpoint of time demands on local units for planning, preparation, and execution, CATTS requires very little, and CAMMS is less demanding than Pegasus or CPXs.

(b) Controller expertise. Centralized control in CATTS and CAMMS offers another advantage—that of controller expertise and experience. The influence of controller expertise and training on setting effectiveness is discussed in Chapter 4. CATTS offers controllers with experience, in-depth experience based on interactions with many battalion staffs that use the system. The breadth of experience that can be provided by one group of controllers (CATTS) or by a team that goes from post to post training controllers stands to be most useful. Experienced controllers should be adept at using either setting to its fullest advantage as a training vehicle.

Given these considerations, if access can be obtained, CATTS and CAMMS are recommended for battaltion staff training.

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[16] It now appears that CATTS can be remoted from Fort Leavenworth to home stations. Further, Western European terrain (as well as the Sinai Desert) is being simulated. (Personal communication between Dean Havron, HSR, and I. Kaplan, ARI Fort Leavenworth, 20 March 1979.) Remoting is to be accomplished within the next several months. Advantages and cost reductions of doing this seems obvious.

(2) Degree of automation.

(a) Introduction. CATTS, CAMMS, Pegasus and CPXs may also be compared with respect to their degree of automation and the extent to which a computer is used as an integral part of the setting. Comparisons of relative strengths and weaknesses of battle simulations are not dictated by the extent to which the computer is used *per se*, but from other factors stemming from its use.

CATTS is a computer-driven, real-time battle simulation system. It is the most sophisticated battle simulation for the battalion staff in the Army inventory. Computer software simulates the actions of units in combat by calculating intervisibilities, weapons-target ranges, and engagement outcomes. Records of personnel, equipment, ammunition and POL status are also automatically maintained.

CAMMS is a computer-assisted battle simulation. Maneuver and all organic support units are playable. Player action is entered through terminals. Software is used to account for logistical and administrative status and engagement outcomes.

Pegasus is entirely a manual battle simulation. Controllers are responsible for processing the data and performing the functions handled by the computer in CATTS and CAMMS.

CPXs represent another form of battle simulation. A fully-developed CPX (with manual processing and control) would approximate the concept and operations of Pegasus.

Several pertinent features that bear on the capabilities of settings stem from their extent of automation.

(b) Ease of administration–controller standpoint. CATTS and CAMMS handle movement, engagement, and administrative logistic procedures automatically. This impacts on the controllers in two ways. The reduced processing demands given controllers time to control the simulation and develop the situation so as to enhance realism. Controllers have time to anticipate events and adjust OPFOR applications of tactics accordingly. Controllers have a better opportunity to observe player performance for diagnosis. Company-level player controllers are better able to fully play their role as commanders in responding to battalion orders and to deploy their units. This adds training value to the exercise for player/controllers.

In Pegasus, by contrast, player/controllers are busy processing the mechanical requirements of implementing orders, and are left less time to filter information and act as evaluators.

(c) Quality of setting-based feedback. Computer data handling in CATTS and CAMMS allows the setting to be interactive with instructions given by players and their errors/omissions. Information given players is a result of staff decisions and simulated actions of units who receive orders from the battalion staff. Thus, the consequences of battalion staff actions are reflected in information received as the situation develops. This realism of feedback stands to enhance the training value of these interactive simulations.

Pegasus is also designed to be interactive and to display consequences of player actions. However, the manual system can overload the controllers. If this occurs, training potential of Pegasus may become degraded in two ways. First, events simulated may lag the rate at which they would occur in real time because of controller overload. This detracts from realism. Secondly, information needed to maintain full records of actions/counteractions and their consequences can lead to control system overload. Locally-trained individuals are responsible for administrative/logistics data update. If their full bandwidth must be used solely to maintain the pace of the battle, important administrative/ logistical errors of players may be overlooked. This should not happen in CATTS or CAMMS.

CPXs, if designed to be interactive, can also suffer from the same controller load problems as Pegasus. However, most CPXs are not designed to be interactive; they provide the battalion staff planned inputs on a predetermined schedule. Thus, information provided to players is not dependent on the actual consequences of their decisions and orders. This common criticism has been documented by ARI/Fort Leavenworth.[17]

(d) Information available to controllers. In CATTS, CAMMS and Pegasus, controllers have access to full and complete information about the progress of the battle—the exact deployments of friendly and OPFOR units, casualties to men/equipment, and supplies. They, in turn, are responsible for transmitting selected pieces of this information to the battalion staff player. Controllers are instructed on how to degrade this perfect information when they interact with players. We were unable to examine how closely this degradation process approximates the miscommunications, errors, and degradations of information that are likely in combat. The extent of this degradation may vary with local practice between settings. In Pegasus, for example, the overall information processing load may cause controllers to degrade information in ways that are unique to the constraints of the setting. If questions were raised as to the content validity of information provided by controllers to players, rules for degrading information, and their exercise by controllers, would be a prime area for study.

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[17] Ira T. Kaplan and Herbert F. Barber, *Evaluation of a Computer-Assisted Battle Simulation: CAMMS versus CPX*, Draft Technical Paper, Army Research Institute for the Behavioral and Social Sciences, Alexandria, Virginia.

(e) Diagnosis/evaluation capabilities. CATTS and CAMMS are quite sophisticated in the way in which hypothetical events are reported to players as stimuli and in exercise control. Both CATTS and CAMMS offer excellent means of recording product-type performance measures. CATTS uses a simultaneous 20-channel type for recording all events as they occur. Portions of this tape can be played back during exercise critiques. CAMMS supplies printouts that provide a quantitative history of the exercise. Neither, however, have formalized procedures for collecting process-type information during the exercise. Given this lack of doctrinal guidance, the extent to which these settings fully exploit their potential for providing diagnostic process-type feedback remains conjectural.

Pegasus has the most comprehensive set of materials for diagnostic evaluation of staff performance. The package consists of predetermined inputs for attack and defense missions, with guidance and cues for evaluators as to what to look for keyed to each input. Evaluation forms are included. The inputs are designed to test the command groups' proficiency in specific critical tasks and subtasks outlined in ARTEP 100-1. Designed for brigade staff functions, the Evaluation Play is adaptable to battalion staff functions as well. Use of the Evaluation Play contradicts an entirely "free play" philosophy of CATTS and CAMMS. However, its potential for providing diagnostic information about staff performance should be excellent.

CPX evaluation capabilities are entirely locally determined. CPX support requires a major resource commitment for planning, scenario and message development, controller training and conduct. The temptation would certainly exist to save time and resources in the area of evaluation. Whether this happens and to what extent is not known.

c. **Company and Platoon Level Battle Simulation.** At present, Dunn-Kempf is the only official company-platoon level battle simulation in the Army inventory. SCUE has been developed by ARI as a research tool. Since the training manager does not have SCUE as an option, comparisons are from our own perspective, not that of the training managers.

As with the battalion-level simulations, the two settings are fundamentally similar. A few differences that are, or may be, pertinent to future versions of both will be discussed.

SCUE incorporates the use and effects of individual weapons (M-16); DunnKempf does not. If Dunn-Kempf is to be extensively used as a platoon-leader/ sergeant training device, consideration should be given to incorporating M-16 effects.

Dunn-Kempf uses OPFOR tactics. Implementation of OPFOR tactics into SCUE should be encouraged.

As a research instrument, SCUE uses more extensive data collection and recording procedures. These procedures can offer process measurement capability if adapted to Dunn-Kempf. Also, the position location and movement recording system used in SCUE enhances its capability to replay events. This appears to be especially valuable in training in maneuver and in use of terrain.

Both settings offer the company and platoon leaders a far better view than he will get on the battlefield. This can be advantageous in early training in teaching appreciation of terrain, maneuver, overwatch, etc. It is a fact of combat that platoon leaders will normally see but parts of the entire platoon; the fraction of the company that the company commander can see is far smaller. Platoon or company commanders who let themselves become *accustomed* to the unparalleled view provided by the game board, however, will be in for some rude surprises when commanding units wither in the field or in combat. Nonetheless, both settings can be useful in practices of planning, in teaching tactical concepts, developing and disseminating mission orders, and in using terrain to advantage.

In sum, Dunn-Kempf and SCUE should be viewed as complementary. As breakthroughs are encountered with SCUE, they can be incorporated into DunnKempf where appropriate. Similarly, SCUE can be used as a test bed for further developments of Dunn-Kempf.

CHAPTER 4

CONCLUSIONS AND RECOMMENDATIONS

4-1. INTRODUCTION

This chapter summarizes material covered earlier along with pertinent feelings from our Phase I study. These conclusions and recommendations are based primarily on a careful examination of training settings described in Annexes A-I; ongoing research at HSR on conventional and ES exercises and research by others on training settings; and on discussions with researchers and Army officers who are intimately familiar with one or more of the training settings. In most instances, the training value of the several settings has not been validated by empirical studies. Its intent is to summarize the state-of-the-art, to provide guidance for use of existing settings, and to suggest direction for further inquiry.

However, its conclusions and recommendations should be of interest to the three groups closely involved in Army training–local training managers; headquarters personnel responsible for providing training policy and guidance; and scientists responsible for research in Army training. It covers the following topics in order:

- Major conclusions derived from Chapter 3 analyses.
- Guidelines for the conduct of training in any setting.
- Preferred sequences of training settings and supporting reasoning. Sequences stem from Chapter 3 conclusions and applications of learning theory.
- Trends in battle simulation and their applications for battalion commanders and staffs and for company leaders.
- Recommended areas for emphasis in the planning and conduct of field exercises.

4-2. MAJOR CONCLUSIONS

Conclusions derived from comparisons between and among training settings presented in Chapter 3 are summarized below. Collectively, they provide a framework and a basis for recommendations as to the use of training settings presently and in the future. These topics are more fully explored in the remaining sections of this chapter.

Field exercises compared with battle simulations for training battalion commanders and staff:

- Battle simulations–CATTS, CAMMS, Pegasus–provide an excellent means of training battalion command and staff who primarily work in an information medium in principles and procedures of battle management.

- Battle simulations can provide battalion staffs an opportunity to deal with a variety of combat situations which cannot be represented, or which can be introduced only at great cost in field exercises–play of the defense mission while against much stronger forces; operations against Warsaw Pact tactics; realistic play of rules of engagement and casualties; response to air strikes; play of EW; etc.

- Battle simulations for battalion command and staff more directly bring out training objectives. The scenario is more readily controllable so that relationships between scenario events and trainee response to those events is more direct than in field exercises.

- Battle simulations provide a more manageable and direct means of measuring and evaluating performance than do field exercises. Critiques can be more thorough; they can be more easily held and fitted to prior actions of battalion staff members.

- Simulations provide a much more economic means of training leaders than do field exercises.

- It is very difficult to conduct battalion field exercises so as to fully utilize training time for all members of the battalion.

- Nonetheless, field exercises provide all battalion leaders an opportunity to operate in a four-echelon command chain and to deal with the faulty communications, equipment breakdowns, and human errors indigenous to field operations. It follows that if lower echelons are not realistically exercised, the training value of the field exercise to battalion staffs may be no greater than what is achievable in less costly board gaming.

- Field exercises should be conducted so as to fully exploit the unique opportunities for training this medium provides. These include practice in leadership; troop leading procedures and supervision for all leaders at all echelons; establishing and reinforcing habits of discipline;

and allowing peers opportunity to coordinate with one another to carry out mission plans. Battalion field exercises observed did not do this well.[18] A potential advantage of ES is that it may encourage more effective exercise of lower echelons.

Company field exercises compared with battle simulation for company and platoon leaders:

- Battle simulations for company and platoon leaders are perhaps more limited in total coverage of leader tasks than simulation for the battalion staff.

- In battle or field exercises, company and platoon leaders operate in a mixed medium. In battle simulations (Dunn-Kempf), leaders can see locations of all their units/elements; simulations unrealistieally unburden company and platoon leaders.

- Nonetheless, battle simulations can provide practice in planning, formulating orders, and tactical procedures.

- Field exercises do have certain unique advantages. See field exercises for *battalions (above).*

- Field exercises at company and platoon levels can more readily be managed to fully use training time than can field exercises at battalion level.

Field exercises (conventional compared with engagement simulation):

- Conventional exercises focus on the procedural aspects of conduct of ARTEP missions.

- Engagement simulation is superior in teaching terrain appreciation, and use of cover and concealment.

- The usual use of ES provides training to both sides; the OPFOR in conventional exercises typically receives little training.

- Engagement simulation has greater training value for individuals and weapons crews because of immediate and valid feedback.

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[18] ARI Technical Report TR-78-A26, Volume 1, *op. cit.*, November 1978.

- Engagement simulation requires greater controller expertise for conduct of exercises, assimilation of information about performance, and conduct of AARs.

- The engagement simulation method of providing feedback (AAR) is more conducive to individual learning.

- Engagement simulation enhances troop motivation and presumably troop readiness to learn.

Battle simulations compared:

- CATTS/CAMMS reduce the preparation requirements at local levels.

- Since computers reduce controller loads, CATTS/CAMMS offer more consistency in exercise control than Pegasus or CPXs.

- CATTS/CAMMS offer more spin-off training value for company-level player/controllers.

- Currently, Pegasus has a more detailed diagnostic system.

- CATTS/CAMMS/Pegasus have more training benefit because of their interactive nature and feedback of consequences than do non-interactive CPXs.

- The ability of CATTS to play back would appear very valuable for critiques; reportedly, this capability is now not used very much.

- CAMMS printouts provide valuable critique material.

- Dunn-Kempf and SCUE offer excellent training in terrain maneuver planning and appreciation of capabilities of weapons.

4-3. FACTORS AFFECTING TRAINING EFFECTIVENESS

In Chapter 3, several subsets of training settings were compared. These comparisons are intended to make explicit factors that training managers should consider in selecting training settings for battalion elements. Regardless of the settings selected, training managers must fully exploit their training value. Here, three conclusions seem compelling.

- The use of any particular setting does not automatically provide effective training.

- If used wisely, all settings can provide beneficial training.

- In the process of planning and conducting any training exercise, many factors exist that have perhaps greater potential for influencing training effectiveness than the training setting itself.

A number of such factors were identified and their potential for influencing training effectiveness came to be recognized. This section identifies those factors, describes how influence training effectiveness, and where possible, provides guidance for their control. Most of these guides may be found in current training literature. They are cited here because, in the conduct of training, they are often overlooked.

a. **Training Needs and Objectives.** Establishment of training needs and objectives is central to training effectiveness. Scenarios, instructions for evaluator/ controllers and points of emphasis in diagnosis/evaluation all proceed from training needs and objectives. Training managers and leaders of units to be trained share the responsibility for assessing training needs. Any exercise can be conducted without training objectives being made explicit. However, conduct of an exercise without prior establishment of training objectives makes it difficult to document what has occurred, or to determine status of personnel who have completed training.

b. **Scenarios.** Scenarios call for performance of those duties logically subsumed under training objectives. All settings lend themselves to the play of a variety of scenarios. (In some cases, only a limited number of scenarios is available.) The degree of structure or free-play to be used in a scenario is important and should be derived from training objectives. Existing or "off-the-shelf" scenarios can be used "as is," providing they meet training objectives. The temptation of using a pre-existing scenario just "because it is there" should be avoided. Scenarios can be adapted and modified to better bring out tasks called for in training objectives.

c. **The Control System.** The control system consists of rules, controllers who enact the rules, and equipment used by controllers as job aids. In many settings, rules of movement, engagement, etc., are strictly defined, and equipment for enacting those rules is well developed. However, controller roles can be strictly or loosely defined.

The training value of any exercise is determined in large measure by the capabilities of controllers. Adequate training of controller teams is a must. All settings need controllers who are senior and more expert than participants. This is often not attainable.

It is then left up to controller training to make up for expertise not found in selected controllers, in addition controller indoctrination. In settings where one-sided, highly structured objectives and scenarios are used, "expertise" can be trained. As settings become two-sided or free-play is added, experience becomes more critical. Finally, control procedures must be enacted with minimum interference to actions of units being trained. This requires teamwork which can only come through controller training.

d. **Participants (troops and players).** Participants can contribute as much to the effectiveness of any exercise as they can derive from it, providing some general conditions are met. Their experience as individuals and/or their prior practice should provide sufficient proficiency that they are reasonably well-prepared for the exercise. Players need to be told what the training objectives are, so they will know what to expect and what is expected of them. This will help establish interest and motivation in the exercise. Interest and motivation can then be maintained by conduct of proper diagnostic evaluations and good critiquing form.

e. **Evaluation.** Training effectiveness is dependent upon comprehensive, effective evaluations. Evaluations should follow up behaviors derived from training objectives. Comprehensive, valid, and timely feedback must be provided if substantial performance improvements in successive training sessions are to be realized.

Since most settings require the same individuals to control and to evaluate, systematic training of evaluator/controller teams is a must. Sufficient time should be allocated to planning how performance will be observed, rated, and how feedback will be provided.

In sum, evaluation and maintaining a record of performance is essential to all training settings. Evaluators/controllers must be trained so they can do this well and with confidence.

f. **The Learning Process in Training Settings.** Taken together, the above described elements which deal with the management of collective training are ordered to facilitate the learning process. First, trainees must understand the purpose of the exercise. Exercise objectives are discussed. This establishes the expectations of both performers and trainers/controllers/evaluators for any exercise in any setting. Secondly, if feasible, correct performance should be demonstrated or described. This is obviously easier for some settings than for others. Next, in structured situations/missions, performers are given the opportunity to practice. Actions are recorded as they happen. Records may be made by evaluator/controllers and/or by recording equipment. Tactical doctrine is invoked to evaluate the likely effectiveness of actions in a combat situation. Product measures can be used to document outcomes; process measures to help pinpoint reasons for these outcomes and errors/omissions in performance. Next, trainees are critiqued. Specific feedback is provided in a positive manner, so that trainees can recognize their

errors and determine how to correct them. Finally, time and situation permitting, trainees are allowed to practice again, to correct earlier deficiencies and reinforce correctly learned knowledges and skills. This process is cyclical; the information presented as critique or feedback really establishes the objectives for the next practice setting.

g. **Knowing and Exploiting Training Settings.** Each of the training settings examined has inherent strengths and limitations. Managers must be aware of the advantages and limitations of each setting. Advantages should be exploited. For example, field exercises should emphasize tasks that can best be practiced in this expensive setting: establishing lateral and vertical communications, creating bonds of discipline, acceptance and delivery of orders, supervision, troop leading procedures, etc. Settings tend to be complementary. Training objectives that cannot be accomplished in certain settings can be accomplished in others. For example, using full-scale battalion exercises to train battalion staffs in planning is wasteful; this task can be done better by simulation.

4-4. SUGGESTED SETTING COMBINATIONS FOR TRAINING

a. **Introduction.** This section develops considerations for combining and sequencing training settings in battalion training programs and presents example sequences as applications. The combinations are derived from an examination of the several settings and applications of principles of learning. The suggestions which follow are based on best judgments. They make certain assumptions about transfer of training and operational feasibility which need to be verified empirically.

b. **Preliminary Considerations.** Several factors bear consideration. As stated earlier, settings should be adapted or modified to fit specific training objectives; for example, the Dunn-Kempf terrain board can be used to practice movement over terrain without playing engagements. Similarly, situation descriptions and brigade operations orders (OPORDS) from CPX scenarios can serve as input to a short battalion staff planning exercise. Such uses call for imaginative utilizations of settings for which no amount of structured guidance can or should attempt to provide. Finally, prescribing set sequences is somewhat contradictory to the current emphasis for flexibility in planning training programs. A training exercise should diagnose as well as train. Depending on performance during the exercise, new approaches or sequences may be called for.

c. **Principles of Combination.** Examination of the strengths and limitations of individual settings yields certain guiding principles as to how settings may best be sequenced. follow.

- Use simulations to teach basic tactical concepts and procedures; planning and preparation and dissemination of orders, and skilled use of tactics. Proficiency in planning/coordination is prerequisite to any successful operation. Simulations offer relative low-cost practices in attaining these skills.

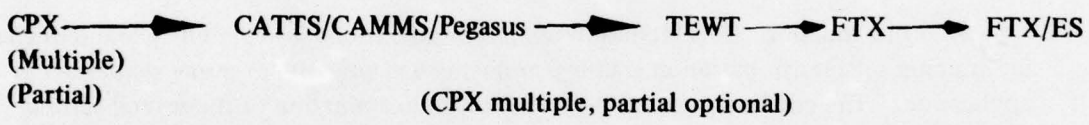
- Use conventional FTXs before FTX/ES. This allows for structured practice/reinforcement of planning and intra-unit coordination before application of these skills in free-play.

- Use progressive training from small to large units–squad to platoon to company. Some level of proficiency of smaller elements should be attained before these elements operate together.

- Use FTX/FTX ES as the culmination of training. They are largest, most expensive and most complex, and offer closest analogs to combat.

d. **Example Battalion Staff Training Sequence.** Figure 4-1 outlines an example sequence of training settings for a battalion staff element.

Figure 4-1



This sequence capitalizes on the low-cost CPX or CPX-like exercises as the foundation for more complex and expensive simulations and field exercises later. Initial exercises would serve to familiarize the staff with individual duties and how they are coordinated in tactical planning up to the point of delivering the OPORDS. Only core staff members may be involved in "walking" through a planning exercise. Successive sessions would begin to integrate activities of the Assistant S-3, Operations NCO, and leaders from support elements (artillery, air, medical, maintenance, signal, etc.) until the point is reached where the battalion would be ready to deploy. In these exercises, internal feedback may well be sufficient.

Movement to a battalion level battle simulation is the logical next step after achieving proficiency in initial planning and procedures. Here, the staff and company commanders will be able to concentrate on the adjustments required in a tactical interactive situation and receive an informal assessment of their strengths and weaknesses. Depending on the outcome of this training, the training manager and battalion commander may opt for further partial CPX-like exercises to remedy deficiencies. Company commanders may desire to use DunnKempf to practice on their shortcomings.

The TEWT places the battalion staff and command elements on actual terrain and allows them to experience as a group the constraints posed by distance, visibility, weather, communications and the inevitable equipment failures.

After TEWT, the group can move to a large scale FTX. This, of course, assumes that training of companies, platoons, and squads has taken place concurrently with battalion staff preparations. The FTX puts the entire four-echelon organization into operation and places demands on leaders for troop leading procedures, supervision of order execution, etc. During the FTX, ARTEP missions can be rehearsed in a controlled format.

As a culmination, given MILES, the battalion can participate in engagement simulation exercises. A four-day field exercise can be split into two days of FTX conventional and two days of engagement simulation. As previously mentioned, it will be the closest thing to combat that the battalion can expect to experience. However, battalion level engagement simulation is still under development. The best that can be offered at this time is company level engagements.

The recommended sequence differs from the one provided in the current ARTEP 71-2, Chapter 10, in several important ways.

It does not include Dunn-Kempf as a training tool for *battalion staff*. The Dunn-Kempf terrain board is limited in its capacity to realistically deploy a battalion size element. Further, it is assumed that at the battalion staff level, individuals will be well-experienced in the appreciation of terrain and weapons lethality.

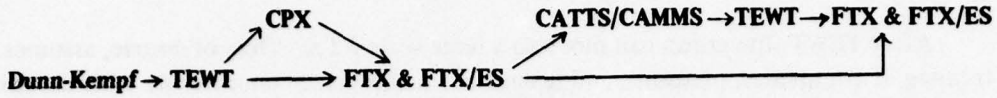
The sequence suggested above takes more liberal license with the CPX utilizing its requirement for rather detailed planning in conjunction with map exercises to build fundamental skills while in garrison.

ARTEP 71-2 suggests use of both CAMMS and CATTS. Accepting the differences noted in Chapter 3 of this volume, they provide generally equivalent training in critical staff functions and can be substituted for one another.

A critical point of *agreement* is the position of the FTX in the training process. The FTX is expensive; it should not be used to train either the command/ staff group or troops in their basic functions for which other settings are better adopted.

e. Example of Company-Level Training Sequence. Figure 4-2 outlines a sample training sequence for a company commander. This sequence illustrates the company commander's pivotal role as an intermediary between his unit on the terrain and the battalion staff he must communicate with. The items printed high in the sequence (CPX, CATTS/CAMMS, TEWT, FTX and FTX/ES) are to indicate his participation in training as an extension of the battalion command group. The lower items represent his role as a commander of platoons.

Figure 4-2



Early exposure to Dunn-Kempf will give the company commander an appreciation for weapons lethality, terrain, and the complications of maneuver. To avoid development of over-reliance on a complete view of his elements, TEWTs should be inserted in the process. Iterations of Dunn-Kempf-TEWTs would be desirable. Participation in CPXs run by the battalion staff establishes the linkage between company commander's requirements to interact with the battalion and their supervising responsibilities. Field exercises provide experience in troop leading procedures and communications. They also give the opportunity to operate on tactical plans and to learn from mistakes. As discussed in Chapter 3 of this volume, participation in CATTS or CAMMS as a player/controller has good training value. In the remainder of the sequence, he participates in battalion TEWTs and FTXs. This provides further practice in vertical communication/coordination link--ages required in the four-echelon organization.

f. **Example of Platoon-Level Training Sequence.** Figure 4-3 outlines an example of a platoon-level training sequence. At the platoon level, the emphasis is necessarily placed on *maximum* opportunity for experience in conduct and supervision of hands-on tasks and troop leading procedures. Dunn-Kempf can be used to teach lessons/tactical concepts before their units go to the field. After procedural practice in fire and movement, cover/concealment, terrain and route selection in conventional field exercise format units should be ready for ES-type exercises. The platoon's role organic to the company is established and practiced in company-level TEWTs and FTXs.

Figure 4-3

g. **Summary.** Use of the example sequences described in d-f above suggest ways to combine training settings for battalion elements. There are others, and some may be more desirable. The critical feature of any combination is to provide for a logical progression of learning: planning to execution, concept to operation, simple to complex, in order to systematically construct a proficient combat unit. Sequencing settings in this manner stands to provide maximum transfer of training from one setting to the next in the sequence.

4-5. BATTLE SIMULATIONS; AN OVERVIEW

a. **Development of Simulations.** Six forms of simulation–CATTS, CAMMS, Pegasus, Dunn-Kempf, SCUE and CPXs–have been described in annexes. In our review of background material, we were often unable to find much information on the background and the development of these forms of simulations. CPXs have been conducted for hundreds of years. With regard to some of the other simulations, it appears probable that the objective of providing physical models of the battlefield situations and obvious needs for incorporating ROE received greater stress than did front-end functional analyses. Such analysis would define the desired scope of each simulation, for whom intended, tasks for which the simulation can be expected to train, means for observing and recording a trace of performance, means for critiquing performance, and the roles of those who plan and supervise training using this simulation. Perhaps such analyses would have produced simulations more or less identical to those now existing. These analyses would, however, have provided better guidance for the use of simulations in training and in particular for measurement of performance and use of such measures to provide feedback. (A fundamental principle of learning is trainees need comprehensive, valid and credible feedback.)

In some instances, at least, it appears that training applications have been developed by trial and error once the game was designed. Some of this is, of course, part and parcel of developmental efforts, even given a front-end analysis. Whether this trial and error of *learning to use simulations* is now complete remains to be determined.

b. **Trend Toward Battle Simulations.** Clearly there is a trend toward the use of more simulations, battle simulations included. There are several reasons:

- Field exercises are becoming increasingly costly to run.
- Increases in mobility with conversion of divisions to armor and mechanized infantry, combined with increased battlefield dispersion, mean that even more space is needed for the conduct of field exercises. Meanwhile, areas for training available on military posts cannot readily be expanded. This trend can be expected to continue.
- Increasing costs and "shrinkage" of terrain areas is occurring concurrently with the growth in the state-of-the-art in simulations. Complex data processing required of simulation of engagements can be conducted at lower costs. Data link capabilities make it possible to remote training from a central setting.

- Based on available evidence, much of it admittedly episodic, there is good reason to believe that all simulations described here can help substantially to train leaders and teams of leaders. Further, prior training of leaders and staff by simulation stands to enhance the value of unit field training.

In spite of these arguments for greater use of battle simulations, there are skeptics.

c. **Counter-Arguments.** Two arguments have been raised against the use of battle simulations. One calls attention to the differences between human behavior on the battlefield and human behavior on the game board; a second argues that simulations are of limited value because the data generated are contrived and "unreal."

The first argument is that simulations have an asceptic quality when players know that the events reported are not occurring. Notably absent is the blood, guts, and casualties, the fatigue and fear characteristic of combat, and the courage and interpersonal confidence men need for sustenance. But while these aspects of combat cannot be played in field exercises, field exercises appear a much closer approximation than do simulations.

The second theme, namely that simulations are of questionable value because trainees deal with contrived data, we believe to be much weaker. Both combat and field exercises introduct a variety of permutations of information that, for practical purposes, are infinite. At any level of command, no two situations will offer precisely the same problems. Actions, counteraction, counter-counteraction, etc., create a great variety of branchings. It is difficult to argue that any one simulation or play of the battle is more "real" than another. In any case, features of information that is processed in simulations can be compared with orders, radio traffic, and unit positions in field exercises. Speaking now of the battalion staff, to the extent that information provided in simulations differs from that which occurs in field exercises, instructions to those who play the role of company commanders and OPFOR can be modified as indicated.

d. **Simulations for Training Battalion Commander and Staff.** As indicated in Chapter 3, there are compelling reasons to believe that battle simulations can serve as an excellent vehicle for training the battalion commander and his staff. Advantages of simulations have been summarized by their proponents.[19] Of particular interest is the fact that in simulations and in combat, the staff works basically in an information medium. Granting needs for personal reconnaissance in combat or field exercises, the battalion

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[19] Army Training Support Center Bulletin No. 78-4, *op. cit.*

staff in either of these or in simulation processes information *about* events or representations thereof. Hence, the transfer of training in simulation to field or combat training should be high. The writers feel less confident of the transfer from company or platoon simulations to field exercises or to combat.

e. **Simulations for Training Leaders in the Company.** As we go up the chain of command to platoon and then to company, we find that leaders at these levels see fewer of their subordinates; seldom in battle would they see them all at any one time. Platoon and company leaders must assume that subordinate elements are in their assigned positions; when directed to move, they assume that—in a prescribed time—they will have done so. Communications is partly by radio. The platoon leader and company commander must work concurrently in two media. Like squad leaders, they have substantial access to the sights of battle and communicate directly face-to-face to a considerable extent. However, they also have significant data storage tasks and make extensive use of radio to command and to provide reports to higher echelons.

Simulations which proport to train leaders in the company should work in a mode that resembles the battlefield situation described in the preceeding paragraph. Most simulations have the potential for operating in such a mode. As noted in Annex I, page 140, battle simulations for company commanders may be played in the open or closed mode. Played in the open mode, commanders see all of their own elements plus detected enemy elements. All elements are displayed. The closed mode has platoon leaders intervening between company commanders and the board. Consequently, the company commander must obtain his information from radio reports from platoon leaders, each of whom has a board. The two modes taken in order with the open mode played first, should permit the company commander in incremental steps to become accustomed to responding to information about the battle.

In general, almost all simulations are able to cover important parts of these leaders' tasks:

- Tasks involved in the receipt of orders from higher headquarters, mission planning, development of orders for their own subelements, and transmissions of these orders.

- Practice in tactical procedures involved in coordination of lower echelon units.

- Initial appreciation of terrain, plans of maneuver, formations, dispersion, and weapons lethality. Here the realistic simulation can provide and ideal picture of how bounding overwatch, for example, is portrayed. The leader can carry this cognitive map with him and try to apply it to actual terrain.

f. **Summary; Future Directions.** Evidence suggests that the training capabilities of all simulations described in this document are substantial. But much of this evidence is episodic. It is not based on studies that, proceeding from training objectives and definition of tasks, provide empirical data in the form of stable learning curves.

(1) Guidance for training managers. Nonetheless, based on data collected here, guidance has been provided in Section 4-3 for the conduct of training in any setting. Section 4-4 has described preferred sequencing of settings with supporting rationale.

(2) Research directions. Given the trend toward greater use of simulations, further research is indicated in the two areas above. A more incisive analysis of training in individual settings might well improve the training value of each. It should also provide information as to how simulation can be better integrated into a schedule that includes field exercises.

g. **Continued Dissemination of Simulations.** Clearly from the above discussions, there are many questions which remain to be answered by research and experience. However, the reasons behind the trend to more battle simulations—cost advantages, maneuver area limitations, accurate force ratio representation, etc.— do and will continue to exist. Further, there is, at present, more than enough training benefits in simulations to warrant their continued development and dissemination to the field as research seeks answers to questions such as those posed above. In particular, two areas can be pursued:

- Continued emphasis on exploiting the capability to export CATTS by remote data links. This emphasis will retain the advantages of permanent controller teams. It will also make CATTS a more viable option for the training manager by increasing its availability.

- Increase the communication between field training managers and simulation proponent agencies. As stated before, the value of any training setting is enhanced if it can be adapted to fit specific training needs. Explore the feasibility of giving training managers choices of terrain, scenarios, missions, and special emphasis on selected tasks that derive from key training objectives.

4-6. RECOMMENDATIONS FOR FIELD EXERCISES

a. Introduction. Field exercises are and will continue to be a necessary and integral part of training programs. Major emphasis in this project concentrated on the better utilization of field exercises. Suggested guidance for improving field exercises been provided. Other research presently underway is enhancing development of engagement simulation as a primary mode of field training.[20]

b. Planning and Evaluator Training. The importance of preparations and evaluator training was stressed in our Phase I study. Guidance for planning and conduct of company level exercises, to include lesson plans for training evaluators, is provided in another Phase II report.[21] Much of this guidance was derived from observations of what we conceived to be faulty practices in the Phase I study. This guidance is designed for use by operational units. It represents a complete treatment of content and procedures for evaluating units in conventional field exercises. However, to use the guidance requires time for planning, training of instructors, and conduct of the instruction. As stated in Chapter 1, time is what training managers do not have. Further efforts, then, are required to provide the training manager with the same level of guidance, but in ways that save him time and do not force him to expend more time. This represents a considerable challenge. There are no easy solutions; but possible approaches must be explored.

c. Exploitation of Field Exercises. Phase I observations indicated that field exercises could be used more efficiently. In preparing this report, faulty practices observed in the Phase I study became more salient–specifically those that bear on development of knowledges and skills that can *only* be displayed in field exercises. These specific practices are:

- Opportunities of lower echelon leaders to practice troop leading procedures.
- Opportunities of leaders to practice and become accustomed to supervision, exercise of discipline, and to develop unit integrity.
- Opportunities of peers to coordinate their activities and aid and assist one another.

The conclusions from Phase I and this report point out that future field exercists *must* be better utilized and more fully exploited for their inherent advantages.

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[20] Contract DAHC 19-76-C-0049, Refinement of Engagement Simulation (REALTRAIN) Training Techniques for Combat Arms Units.

[21] *Improved Army Training and Evaluation Program (ARTEP) Methods for Unit Evaluation–Volume IV, Guidance for Planning and Conduct of Company-Level Field Exercises.* Final Technical Report. Human Sciences Research, Inc., McLean, Virginia: 30 April 1979.

d. Engagement Simulation. Engagement simulation field exercises permit practice in certain knowledges and skills that cannot be brought out as readily in conventional field exercises. Specifically, ES provides a much more realistic play of the battle. ES demands a high level of competence on the part of evaluator/ controllers. Thus, sufficient time must be allowed for such training. However, engagement simulation has not been around long enough for full appreciation of its advantages. Issues concerning the integration of engagement simulation into training programs are still being discovered and discussed.[22] It appears that, as engagement simulation is maturing and being implemented, it has profitted from lessons learned in conventional field exercises. An example is in the development of standard guidance packages. Developers of engagement simulation should continue to look to the lessons being learned in the continued refinement of ARTEP.

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[22] *The Development of Engagement Simulation-Based ARTEPs. Final Report (DRAFT).* Human Sciences Research, Inc., McLean, Virginia: 5 December 1978.

ANNEXES

ANNEX A.

FIELD TRAINING EXERCISE (FTX)

1. **Echelon and Type Units Exercised.** For purposes of the comparison of training settings within an ARTEP context, consideration is limited to platoon, company and battalion echelons of all maneuver units. Field training exercises are appropriate from fire team through corps or field Army level.

2. **Special Facilities/Equipment.** Units involved in an FTX should have all field gear specified in their TOE. Control/evaluation teams will require additional radios, vehicles, and pyrotechnics such as artillery simulators, smoke grenades, and smoke pots. Specific requirements, which vary by unit and mission, are indicated for each mission in ARTEP 71-2.

3. **Means of Terrain Representation.** Units maneuver over actual terrain.

4. **Means of Representing Weather and Other Impinging Conditions.** Units exercise in prevailing weather conditions.

5. **Availability of TOE Weapon Systems Organic to Unit.** Organic TOE weapon systems are used.

6. **Availability of Non-Organic Fire Support.** Indirect fire support is almost always represented in field exercises from platoon through battalion levels. This is ordinarily accomplished through the play of FOs and a FSCOORD, and the use of controllers to deliver and mark fires. Depending on local availability and the level of resource commitment, close air support can be played.

7. **Rules Governing Movement.** Condition of ground, vegetation and road availability determine rate of movement. Rates are slow when infantry dismounts.

8. **Rules of Engagement for Weapon Systems.** Rules may be established by exercise planners in varying levels of coverage and detail. Implementation by making the number and type of casualties jibe with range of opposing weapons, their number and lethality is exceedingly difficult in real time. Typically, casualties are declared on an "ad hoc" basis by evaluators. The difficulty of valid realtime play of rules of engagement is usually a weakness of conventional exercises. Typically–in Bn FEXs observed–attempts to simulate firing signatures for larger weapons were sporadic due in part to cost/availability of signature simulators.

9. **Function(s) of Computer (if applicable).** Not applicable.

10. **Application of Probability.** There are reports of use of random number generators to establish casualties. Not frequently used, however.

11. **Extent to Which Scenario can be Manipulated to Accomplish Training Objectives.** The scenario is a series of situations which will confront the unit undergoing training/evaluation. The basic components of a scenario are a general situation, an initial situation and requirement, subsequent situations and requirements, and a time schedule. The scenario basically portrays the expected course of the battle and the play of OPFOR to test a unit's abilities to recognize threats and opportunities presented by each situation, and to react appropriately. Activities required to recognize threats and to plan and coordinate threats are described as training objectives. Terrain selection, the description of the situation, mission orders to the unit, and play of OPFOR are planned so as to provide units freedom and choices that would be available in combat to accomplish these objectives. The mission(s) assigned to the unit, the actions of the OPFOR, fragmentary orders from the next higher echelon higher echelons. OPFOR actions and frag orders can be modified during the exercise to implement training objectives and/or to expose errors in the unit plan of action or execution of action to teach lessons that can be reinforced in a post-exercise critique.

The extent to which the scenario can be manipulated can be considered in terms of practical limitations which may exist on the varying of scenario elements. Choice and variation of terrain may not be a problem at the small unit level, but a number of posts are not able to accommodate battalion-size maneuvers, or must use nearly the same terrain for every exercise. It is difficult if not impossible to dedicate a sufficiently large OPFOR to represent realistic force ratios for defensive (friendly) missions, especially in larger unit FTXs. If a post is close to population concentrations, there are likely to be restrictions on the practice of EW and ECM procedures such as jamming. In the main, built-up areas are not available for FTXs. Additionally, while chemical and nuclear warfare can be simulated in an FTX environment, large numbers of casualties are not played; declared casualties receive no training. Casualties may be tagged, sent to the rear and reprocessed to play role of support personnel. Safety regulations may restrict execution of maneuver plans.

Nonetheless, in light of the many tasks and situations for which a combat unit must be prepared, a great deal of flexibility is available to permit scenarios to be set up so as to bring out activities logically derived from a variety of training objectives. However, by contrast with simulations such as CATTS and CAMMS, it is much easier to structure information than to structure the real events which will generate that information. Thus, scenario flexibility is not as great in an FTX as in a training setting in which the presence of troops is simulated.

12. **Capability/Feasibility of Halting/Replay of Parts of an Exercise.** An FTX can be halted at any point that, in the opinion of the exercise director/senior controller, significant teaching points need to be made, a real danger is evident, or that no further purpose would be served by continuing. Stopping play for the first reason is much easier for squad or platoon exercises. In practice, constraints on time in the field are tight, and stopping the exercise may make it impossible to train in all missions for which training is planned. Halting a Bn FEX detracts from realism and valuable training time is lost in sorting units out. It is not recommended. Depending on level of readiness, and particularly if unit readiness is low, post-mission critiques can be held to prevent practice/reinforcement of erroneous actions. Occasions for halting exercises—for example, muzzle-to-muzzle confrontations—can be avoided by a controller team that is alert and anticipates probable mixing of unit with OPFOR, and takes actions to avoid it.

13. **Capability to Adjust Level of Difficulty.** Level of difficulty of missions can be adjusted by variations in orders as to how missions are to be accomplished, by selecting terrain to impede movement and maneuver, by declaring casualties and by increasing size of OPFOR. Resource constraints severely limit the ability to field sizable OPFORs. Cost of increasing size of OPFOR makes it difficult in the field to represent OPFOR realistically for defense missions.

14. **Opposing Force Organization.** FTXs can be conducted with two like-size units opposing each other in a free-play mode. However, research observations and current doctrine favor the use of a dedicated OPFOR which employs threat tactics and can be directed by FTX controllers. Naturally, the type and size of the OPFOR organization varies depending on the type and echelon of the exercised unit and on the unit's mission. Tabs A to Appendices 1 through 50 to Chapter 8 of ARTEP 71-2 (Mechanized Infantry/Tank Task Force) specify the recommended OPFOR organization for each unit mission included in that ARTEP.

15. **Number and Roles of Players.** Generally, all elements of the maneuver unit being trained are fielded, with the possible exception of some elements of the Headquarters and Headquarters Company in a battalion FTX. When the FTX is internally supported, the unit commander would serve as the exercise director, and with designated assistants, would plan and implement the exercise.

16. **Positions With Which Players Interact.** Players at all levels interact with peers and superiors/subordinates in the chain of command. The next higher echelon commander is normally represented by the chief controller. Players at the battalion staff level exchange/coordinate own activities and interact with their counterparts at brigade level, if represented.

17. **Training Objectives That Can be Accomplished.** The ARTEP, in identifying combat critical tasks, conditions and performance standards, provides training objectives for all elements and echelons of a battalion. All can be accomplished in the field.

18. **Command Group Functions That Can/Cannot be Played.** Essentially all tasks and subtasks specified in Chapter 10 of ARTEP 71-2 for the battalion command group can be exercised in a field environment. Some subtasks, such as 10-10-G, "Detect/defeat opposing force air assets," as well as some others in the intelligence area, require special planning and arrangements.

19. **Realism of Information (Input and Feedback) Available to Players.** The amount, speed and accuracy of feedback and other information available at the command level is generated from brigade and through normal channels, and thus realistic for the conditions played, and presumably similar to the information exchange called for in combat. (In some battalion field exercises observed, it was noted that information did not flow as well as it should, either from higher down, or upward.)

20. **Requirement for Player Orientation to Training Setting.** In addition to missions and operations orders being issued down the chain of command, an FTX should be preceded by a briefing on safety, rules of engagement and other special provisions involved in controlling the exercise. Approximately one hour or less would be allotted for such preliminary orientation.

21. **Susceptibility of Setting to "Gamesmanship"; Lack of Combat Realism.** At the lower unit level (platoon and squad) it is a fairly common practice to run a number of units through FTXs, using the same scenario(s). Units that run the problem later may learn from those who went through it earlier. If controllers serve as fire markers and traverse the battle area in marked controller vehicles, troops may learn to avoid them. Men evaluated may argue evaluators out of unsatisfactory ratings. If evaluators are not present, troops may expose themselves unnecessarily and get away with it. A further problem with Mech Infantry Bn maneuvers is that terrain available is limited, and officers/NCOs who have been on the post awhile know it, intimately taking advantage of this information in ways they could not usually do in combat missions involving traversing new ground.

22. **Existence of Constraints or Required Procedures Which are Peculiar to Setting.** Safety regulations, while very necessary, can constrain maneuvers. For example, a minimum distance is required for firing upon personnel targets; and care must be taken in throwing grenades (simulators). Sometimes environmental considerations and limitations on maneuver areas are constraints. The employment of EW may be limited as cited in Item 11. A different type of constraint is that indirect fire is usually marked at the point where it is requested, and thus accurate delivery

of the round(s) is assumed. Casualty assessment is constrained in terms of the means to assess casualties and the credibility of the producing agent. It is difficult for the full impact of the combat force of the OPFOR to be represented or experienced without more simulation of OPFOR weapons (quite expensive) than is typically used. Along the same vein, it is difficult to induce as realistically cautious attitudes as would occur in combat.

23. **Number of Controllers, Positions Played by Each.** ARTEP 71-2, in its suggested support requirements, specifies the *minimum* number and grade of evaluators for each mission. Field observations and work with maneuver units during this project indicate that in most cases, for adequate control and evaluations, these requirements are not sufficient. A minimum of two evaluators should be assigned to a platoon FEX, seven to a company exercise, and about 25 to a Bn FEX. In a Bn FEX, evaluators should be assigned to cover each platoon.

24. **Number of Aggressors, Auxiliaries.** In concept, the size and composition of the OPFOR will depend on the units being evaluated and their assigned missions. Ideally, the strength of OPFOR would correspond to force ratios specified in FM 100-5. This is difficult if the exercised unit is conducting a defense mission where 1:3 to 1:6 friendly to OPFOR force ratios are recommended. The minimum number of opposing force personnel that can be used for any given mission and still provide enough tactical realism to the exercised unit is unknown. Because of this, questions arise as to whether the cost of added personnel (a squad of OPFOR opposing a platoon in training, a platoon opposing a company, a reinforced company opposing a battalion) would be worth the increased value for training.

25. **Requirement for Training Controllers.** ARTEP 71-2, Chapter 5, lays out a sample two-day program of instruction for an E/C School. It includes some theoretical background, emphasis on specific skills needed, information pertaining to the immediate exercise, segments on safety and commo, conduct of a terrain reconnaissance, and a rehearsal or wargaming of the evaluation. As exercises become larger and more complex, there is need for greater emphasis on inter-controller communication to coordinate efforts, and to help others anticipate impending events. At battalion level, special training for TOC evaluators is appropriate. Based on research observations during this project and some field experience, two days of training time for evaluators is minimal. Even this presumes that evaluators-to-be are already well-versed in unit tactics (and/or staff procedures, depending on their assignments). This is not always the case.

26. **Duration of Exercise.** Determined by command planning, and state of unit training, a battalion-level FTX will generally consume 3-4 days, a company field exercise 2-3 days, and a platoon/squad FTX 1-2 days.

27. **Means for Applying Rules of Engagement, Casualty Assessment.** Rules of engagement, *per se*, when developed for FTXs, are applied by evaluators. Casualty assessments depend on evaluator judgments. Casualties may be called for exposed units or personnel who do not use cover.

28. **Provision/Means for Recording Player Responses.** The mission-specific training and evaluation outlines (T&EOs) should be carried in the field by E/Cs. These are primarily forms for recording ratings on specified tasks, but should also be used to make notes of events which are crucial to the mission outcome or of behaviors which should be highlighted and corrected during the post-exercise critique.

29. **Operational Costs.** Computations not available to us.

30. **Set-Up Time.** It is generally feasible (depending on distances) to move the unit from garrison to the field, set up an administrative bivouac, give orientation and safety briefings, issue and check out equipment and simulators and blank ammo, verify control measures, and issue orders in half a day.

31. **Means for Rating Performance.** During the course of the exercise, E/Cs observe the unit to which they are assigned as the unit performs its combat functions. Performance on tasks specified in the mission-specific T&EOs is rated as satisfactory or unsatisfactory relative to the prescribed standards.

32. **Positions Rated by Each Controller.** Generally, E/Cs will be assigned to the unit commanders/leaders (on a one-to-one basis) and others will travel with sub-units, or shift around among subunits. At the battalion level, E/Cs will also be assigned to observe special functional areas such as fire support, A/LOG, etc. E/Cs should be at least branch/MOS qualified for the type of unit they are evaluating, and have operational experience in duty positions they are evaluating.

33. **Objectivity of Performance Indicators/Ratings.** In the present FTX format, performance ratings and indicators are necessarily subjective, since they are made by E/Cs. Validity of ratings is influenced by several factors: (1) the E/C's knowledge of current tactics, doctrine and mission tasks to be performed in the exercise; (2) the extent that the exercise E/Cs use T&E Outlines to cue them as to when to observe performance and to remind them of performance standards; (3) the amount of training given to E/Cs; and (4) the amount of prior planning/coordination that has gone into providing instructions to evaluators. Thus, validity of ratings is almost wholly determined by the effectiveness of exercise planning and E/C training.

34. **Diagnostic Capability**. Conventional FTXs depend on evaluator ratings which are based on T&EOs. Evaluator comments should be solicited as well. Coordination between echelons is covered by T&EO items. Items in currently provided T&E Outlines do not cover actions of Bn commanders in detail, nor do they cover functions of staff positions. Summaries of staff and command functions should be provided to evaluators to improve comprehensiveness of coverage to these duties. Evaluator training, conscientious use of T&E Outlines, and use of items for evaluation of Bn staff and company commanders, can together provide an excellent evaluation capability of process type criteria. Overall scores are computed by addition/integration of scores on T&EO items.

35. **Opportunity/Provision for Critique/Instruction.** Post-mission and post-exercise critiques should be built into the exercise plan. How these are conducted is a matter of user prerogative. Evaluators may, at their option, critique individual leaders or units during the exercise. Procedures should be spelled out in exercise plan and evaluator training.

ANNEX B.

FIELD TRAINING EXERCISE, ENGAGEMENT SIMULATION (FTX/ES)

1. **Echelon and Type Units Exercised.** Engagement simulation (ES) is a generic training concept based on the assumption that realistic simulation of the tactical environment provides the optimum conditions for learning. In its evolution, engagement simulation has taken three forms: SCOPES, REALTRAIN, and MILES. In both SCOPES and REALTRAIN, weapons engagement damage/casualty assessment is performed manually by a system of maneuver controllers. With the introduction of laser equipment, damage/casualty assessment became more automatic and the approach became known as MILES, an acronym for Multiple Integrated Laser Engagement System. SCOPES is designed primarily for infantry squad training. REALTRAIN is designed for combined arms tactical unit (collective) training from squad/section through company level. MILES is designed to permit unit (collective) training from squad/section through battalion level.

2. **Special Facilities/Equipment.** Units involved in ES trainingshould have all field gear (individual and unit) specified in their TOEs. Additional radios and vehicles are required for both REALTRAIN and MILES controllers with the exact number being a function of the type and echelon of unit undergoing ES training. For REALTRAIN ES, each direct fire weapon requires a controller's telescope, which is used to verify "hits," and individual participants are provided numbered helmet covers. Combat vehicles and crew-served weapons must also be provided with number panels. For MILES ES, each direct fire weapon is equipped with an eye-safe laser which is activated when blank ammunition is fired. Combat vehicles, weapons systems, and most individual participants are equipped with a laser-detection system, the activation of which simulates a "hit" or "kill." MILES controllers are also equipped with a laser gun that is used to verify laser-detector system operability. Specific REALTRAIN ES equipment requirements are delineated in training circulars that are currently being prepared. Specific MILES ES equipment requirements are under development.

3. **Means of Terrain Representation.** Units maneuver over actual terrain.

4. **Means of Representing Weather and Other Impinging Conditions.** Units exercise in prevailing weather conditions.

5. **Availability of TOE Weapon Systems Organic to the Unit.** All organic TOE weapon systems can be used in ES. Organic indirect fire weapons, such as mortars, are played essentially the same as in conventional FTXs. The effective play of suppressive fire in REALTRAIN is very difficult. In both REALTRAIN and MILES ES, hand grenades and land mines can be used; however, damage/casualty assessment

for such weapons is based upon the subjective judgment of controllers. In both REALTRAIN and MILES ES, concealment, such as light vegetation, can have the same effect as cover on the damage/casualty assessment for direct fire weapons. By audio signals, MILES can provide targets indications that they are being fired on.

6. **Availability of Non-Organic Fire Support.** Indirect fire support is almost always represented in field exercises from platoon through battalion levels. This is ordinarily accomplished through the play of FOs and a FSCOORD, and the use of controllers to deliver and mark fires. Depending on local availability and the level of resource commitment, close air support can be played.

7. **Rules Governing Movement.** Condition of ground, vegetation and road availability determine rate of movement.

8. **Rules of Engagement for Weapon Systems.** The rules of engagement for ES are designed to realistically simulate the combat environment. They are designed to produce near real-time damage/casualty assessments that are in accord with the lethality for the range of weapons and vulnerability of targets engaged. The rules of engagement, which are enforced by maneuver controllers, are also designed to prevent cheating on the part of tactical participants. Damage/casualty assessment is a manual process performed by controllers in REALTRAIN ES and a near automatic process performed by laser hardware in MILES ES.

9. **Function(s) of Computer (if applicable).** Not applicable.

10. **Application of Probability.** Probabilities do not enter into REALTRAIN ES damage/casualty assessment. Damage/casualty assessment is a function of whether the target REALTRAIN number can be read and whether the cross hairs of the controller's telescope were on the target when the engaging weapon was fired. The built-in logic in the MILES ES laser detector equipment utilizes probabilities based on range to assess a near miss, a hit, or a catastrophic kill.

11. **Extent to Which Scenario Can Be Manipulated to Accomplish Training Objectives.** See discussion of this item, Annex A. ES is usually played as a two-sided engagement. Mission pairings (for example, Hasty Attack versus Defense, meeting engagement) are selected and Fragmentary Orders are prepared for the leader of each side. Each side is given freedom to carry out the mission as leaders see fit (units must stay in prescribed lanes); however, once the battle is joined, the ebb and flow of conflicts between antagonists, each seeking advantage, often lead to critical behaviors that were not previously formulated as training objectives. There is potentially the paradox that the more the exercise is structured to call for innovative tactical solutions, the less control planners have over the achievement of specific training objectives. This trade-off is difficult to evaluate. In any case, greater flexibility requires

controllers to "stay on top of the action" so that critical behaviors not completely anticipated in specifying training objectives can be brought out in the AAR.

12. **Capability/Feasibility of Halting/Replay of Parts of an Exercise.** An ES exercise can be halted at any point that, in the opinion of the exercise director/senior controller, significant teaching points need to be made, a real danger is evident, or when no further purpose would be served by continuing. Stopping play for the first reason is much easier for squad or platoon exercises. In practice, constraints on time in the field are tight, and stopping the exercise may make it impossible to train in all missions for which training is planned.

13. **Capability to Adjust Level of Difficulty.** Level of difficulty in engagement simulation exercises is adjusted by planned variations in force ratios. Field experience indicates that—as in combat—attackers must outnumber defenders by a substantial margin.

14. **Opposing Force Organization.** ES exercises can be conducted with two units opposing each other in a free-play mode. Current doctrine favors the use of an OPFOR which employs threat force tactics and can be directed by ES controllers. The type and size of the OPFOR organization simulated varies depending on the type and echelon of the exercised unit and on the unit's mission.

15. **Number and Roles of Players.** Generally, all elements of the maneuver unit being trained are fielded. When the ES exercise is internally supported, the unit commander would serve as the exercise director, and with designated assistants, would plan and implement the exercise.

16. **Positions With Which Players Interact.** Players at all levels interact with peers and superiors/subordinates in the chain of command. The next higher echelon commander is normally represented by the chief controller.

17. **Training Objectives That Can be Accomplished.** See response to Item 11, this annex. Most developmental efforts in ES have not used formally stated training objectives. Field experience suggests that, in spite of the free-play aspects of ES, broadly defined training objectives can be formulated in advance and the play sufficiently well-channeled to be relevant to most of them. Field observations indicate that training objectives such as those bearing on use of ground for observation and fields of fire and for concealment, rapidly become evident to players, whether stated formally as training objectives or not.

18. **Command Group Functions That Can/Cannot Be Played.** Essentially all tasks and subtasks specified in Chapter 10 of ARTEP 71-2 for the battalion command group can be exercised in a field environment. Some subtasks, such as 10-10-G, "Detect/defeat opposing force air assets," as well as some others in the intelligence area, require special planning and arrangements.

19. Realism of Information (Input and Feedback) Available to Players. Orders and intelligence flow through command channels. Questionnaires submitted to participants in ES field exercises have consistently shown that subjects regard ES exercises as more realistic than other forms of field training in which they have participated.

20. Requirement for Player Orientation to Training Setting. In ES Training, as in conventional FTXs, safety briefings must be conducted and Fragmentary Orders issued through the chain of command. It is also necessary in ES to conduct indoctrination and familiarization training for the tactical players. The indoctrination training involves the rules of engagement and the installation, maintenance, and operation of REALTRAIN and MILES equipment. Familiarization training involves a series of squad/section mini-exercises that provide actual hands-on experience for both the controllers and tactical players in the use of REALTRAIN and MILES equipment.

21. Susceptibility of Setting to "Gamesmanship"; Lack of Combat Realism.

a. Combat Realism. Substantial concealment can block sight and laser beams so that concealment becomes equivalent to cover. It has been difficult in the REALTRAIN version of ES to play or demonstrate the suppressive effects of well-directed volume of fire into target areas. In MILES ES, the near-miss signals are of substantial assistance. Training managers/controllers must take care that exercises do not degenerate into uncoordinated engagements between snipers on opposing sides.

b. Gamesmanship. Personnel can cover up or disconnect sensors (MILES) or numbers on helmets/panels (REALTRAIN). They can fail to activate devices that provide weapon signatures. Field experience thus far indicates that these have not been serious problems, but they do call for command attention.

22. Existence of Constraints of Required Procedures Which are Peculiar to Setting. The setting constraints for ES training are essentially the same as those for conventional FTXs; however, ES tends to induce a more realistically cautious attitude on the part of the tactical players than conventional FTXs. Whether players become casualties in ES training is a direct function of their behaviors on the (simulated) field of battle.

23. Number of Controllers, Positions Played by Each. Controllers perform three basic functions in an ES exercise: (1) making observations on which training diagnosis and evaluation is based; (2) providing or augmenting the mechanism for casualty assessment; and (3) enforcing the rules of engagement. The numbers and duties of controllers performing these functions are quite different,as between SCOPES or REALTRAIN on the one hand, and MILES on the other. In SCOPES or REALTRAIN, controllers are required at a rate of approximately one per crew-served

weapon or combat vehicle and one or two per rifle squad. A senior controller supervises controllers and observes the leader being trained. Observations for diagnosis or evaluation are made by controllers. Controllers provide the mechanism for casualty assessment and enforce rules of engagement.

In MILES, the direct fire casualty assessment is automatic, so that controller functions are reduced to servicing the automatic equipment and augmenting it when indirect fire weapons are used. The diagnostic/evaluative duties can be accomplished by one controller per platoon-sized unit.

24. Number of Aggressors, Auxiliaries. *Engagement simulation* pits one training unit against another. In this sense, no OPFOR is employed. Both units use U.S. tactics. Controllers are required in numbers described in Item 23. The indirect fire simulation system requires an officer or senior NCO, several fire marking computers, and three or more two-man fire marking teams for a company team. A net control fire station is manned by a radio operator who records casualties/events during the course of the exercise.

25. Requirement for Training Controllers. All controllers must be professionally qualified to perform the duties of the individual to whom they are assigned; e.g., a company senior controller must be qualified to command a company, a tank controller must be a qualified tanker. For REALTRAIN, Appendix C of TC 71-5 defines the characteristics of REALTRAIN equipment and procedures that a controller must know and what he must be able to do. Similar training requirements for controllers are under development for MILES. In addition, senior MILES controllers must know the training objectives of the exercise, be able to interpret and apply the rules of engagement, develop the information for and conduct an After-Action Review. Indirect fire controllers must be able to apply the rules for plotting indirect fire, determine their position in the exercise area, and correctly assess casualties. The time frame for this training is not firmly established. As an estimate, two or three days should be allowed for instruction of controllers supplemented by practice exercises for controller training.

26. *Duration of* Exercise. Determined by command planning, and state of unit training, a battalion-level ES exercise will generally consume 3-4 days, a company field exercise 2-3 days, and a platoon/squad exercise 1-2 days.

27. Means for Applying Rules of Engagement, Casualty Assessment. In REALTRAIN, the procedures described in detail in TC 71-5 involve communication by the firer to an accompanying controller by radio to a controller with the target who then declares the target a casualty. It is automatic for direct fire weapons with MILES, and the controller intervenes only in the event of malfunction or interference with laser detectors by players. In both, indirect fire casualties are assessed by controllers as described in TC 71-5. The controller and the exercise unit chain of command enforce rules of engagement.

28. **Provisions/Means for Recording Player Responses.** Engagement simulation–both REALTRAIN and MILES–stresses objective casualty assessment. While in REALTRAIN, controllers need to assume that sights are properly placed and held on the target; this controller task is not particularly difficult. It will be noted that this information is produced by interactions between firers and targets, not the actions of firers alone.

Recordings may be made of traffic on tactical nets. Records may be made of unit positions throughout the exercise.

In addition, a log is kept by the net control station of all casualty assessment communications in REALTRAIN and of all observed firings and "kills" in MILES. A log is also kept of all indirect fire casualty assessment. In MILES and ES, the laser detector equipment on the target records the type weapon that made the kill.

Controllers are debriefed after the exercise to confirm the NCS casualty records and to identify/confirm training points emerging from the conflict between sides that are especially important. Additional information about player activities and the reasons for them will be obtained during the After Action Review with players.

Finally, T&EOs from conventional ARTEPs may be used as is or modified by controllers to record actions of players and units as a whole. By comparison with casualty histories–products–they provide process criterion measures. If used, these lead to a hybrid ES/conventional system of evaluation. Whether checklists are needed in addition to information generated as described above, has as yet to be firmly established.

29. **Operational Costs.** Computations not available to us.

30. **Set-Up Time.** The set-up time for such administrative functions as moving from garrison to the field, selecting and occupying a bivouac or training range administrative area, etc., are essentially the same for ES training as for conventional FTXs. The actual time required for such functions is determined to some extent by local conditions. Additional set-up time is required for ES training to install and check out REALTRAIN and MILES equipment.

31. **Means for Rating Performance.** The philosophy guiding engagement simulation is that effective actions of trainees and their errors and omissions will be revealed during the play of the battle. Thus, units may be evaluated by comparing casualties suffered/received and the ratio of survivors on both sides after the battle. (Allowance must be made for initial force ratios in attack versus defense missions.) In platoon level exercises, effective and ineffective actions of individuals or weapon crews are developed during the After Action Review (AAR) around the history of

casualties maintained by the Net Control System. In platoon-level exercises, an AAR may be held for teams of leaders from each side after the AAR for all participants has been completed.

Thus far in the development of ES ratings, using items such as those found in ARTEP T&EOs has not been a major feature. Controllers are asked to make notes as to effective and ineffective actions. They have not been provided with preformatted checklists to include T&EO type items. Such checklists may be used as an auxiliary feature. However, once the battle is joined, task requirements *emerge* from the *interactions* between sides. All these actions cannot be forecast in advance. Questions arise as to the extent to which T&EO type lists of items can anticipate these actions, hence as to the value of lists. (This problem of observing critical behaviors not anticipated in rating items arises in conduct of conventional exercises as well, but much less frequently than in ES exercises.)

32. **Positions Rated by Each Controller.** The primary function of controllers (REALTRAIN) is to insure valid casualty assessment and that identity of casualties is made known immediately to controllers on the opposing side and the NCS. In MILES, casualty assessment is automatic; however, controllers are asked to note effective or ineffective actions of the vehicle/unit they accompany. This information can be brought out in the AAR. The senior controllers who accompany the unit commanders/leaders should also note training points pertaining to effective/ineffective tactical direction provided by the leader they observe.

33. **Objectivity of Performance Indicators/Ratings.** The primary criterion data consist of a time history of casualties. Positions of units may also be recorded on a time line. In REALTRAIN, target hits must be confirmed by controllers using boresighted scopes; in MILES, they are produced by the logic built into the laser detectors installed on the target. While neither system is foolproof, with proper care and use both can provide unbiased, highly objective data.

Identification of kills and weapons that produced them does not necessarily allow pinpointing of errors/omissions of the target as casualty nor effective action of the firer. This information can be brought out in controller debriefs and AARs.

34. **Diagnostic Capability.** The principal diagnostic tool to date has been the After Action Review, a guided discussion in which one of the senior controllers using the NCS record–amended as needed at the controller debrief–leads the participants to reconstruct the chronology of the action and identify the tactical lessons to be learned as they go through it. For small unit actions, this has been found to be a very powerful diagnostic method in the hands of a skilled discussion leader. The present ARTEP T&EOs would be of some value. Revised T&EOs for the ES ARTEP are under development, but they have not been significantly employed in ES exercises to date.

ES permits training diagnosis and instruction to be built around the results of exchanges of fire between sides, which are made known and discussed in AARs. Assuming effective controller (REALTRAIN) or laser-sensor (MILES) performance, casualties are objectively determined. However, preceding events and the reasons casualties occurred must be provided either by controllers or by discussion among controllers and players in the After-Action Review (AAR). Full exploitation of the training value of engagement simulation as a method requires alert, knowledgeable controllers. Thus, in ES, the results of errors and poor performance are dramatically brought out.

35. Opportunity/Provision for Critique/Instruction. The conduct of an After-Action Review is an essential element of the learning process in the ES exercise. The tactical personnel are acutely aware of the outcome of an exercise as it affects them, but rarely aware of the causative factors which become apparent on a review of the whole exercise. The overview of the causative factors is the most effective when developed through the participants' own exchange of information and an analysis of the effect of each other's actions.

After an ARR for all tactical participants, AARs are sometimes held for the leaders of each side, with the emphasis being on plans, execution of tactical concepts, problems of execution, faulty communications, etc.

As techniques of engagement simulation training have evolved, it has become apparent that the competitiveness, enthusiasm, and interest that the two-sided play engenders, can be maintained in a well conducted AAR, with all players from each side participating and controllers overwatching. Participation of controllers and of players from both sides provides an effective cross-check on a good means of identifying errors and effective behaviors. However, the AAR must be conducted in a manner different from the usual critique to maintain this atmosphere and enthusiasm. Experience to date shows that some can do it; some cannot.

ANNEX C.

TACTICAL EXERCISE WITHOUT TROOPS (TEWT)

1. **Echelon and Type of Units Exercised.** The TEWT can be used to train commanders and staff officers of any maneuver unit up through brigade level. It is also used by company commanders to train platoon leaders and squad leaders. It is probably used more frequently at the company level and below.

2. **Special Facilities/Equipment.** The only resources required to conduct a TEWT are use of the terrain, maps or terrain sketches of it, binoculars and possibly vehicles or aircraft may be useful.

3. **Means of Terrain Representation.** The exercise is conducted on actual terrain.

4. **Means of Representing Weather and Other Impinging Conditions.** Existing local weather conditions.

5. **Availability of TOE Weapon Systems Organic to Unit.** This item does not apply.

6. **Availability of Non-Organic Fire Support.** This item does not apply.

7. **Rules Governing Movement.** Time and distance factors for maneuver units relative to the particular terrain must be considered in developing tactical plans, and in monitoring their execution.

8. **Rules of Engagement for Weapon Systems.** This item does not apply. TEWT involves the development of solutions to specific situations and requirements tailored to the selected terrain. The presence of an OPFOR, engagements, or casualty assessments are not represented.

9. **Function(s) of Computer (if applicable).** Not applicable.

10. **Application of Probability (if applicable).** Not applicable.

11. **Extent to Which Scenario Can Be Manipulated to Accomplish Training Objectives.** The scenario for a TEWT consists of a general situation, a special situation, and a requirement. Based on these factors, the participants plan and develop

tactical solutions, appropriate to the terrain, which are then evaluated against standards for these requirements. Therefore, scenario manipulation is a matter of selecting terrain and designing combinations of situations and requirements which emphasize specific training objectives. Very often, an exercise intending multiple training objectives will consist of a series of situations and requirements on different terrain sectors. Essentially, the extent of scenario manipulatability is sufficient for the nature and purposes of a TEWT.

12. **Capability to Halt Play or Replay Events.** Because a TEWT involves planning activities rather than execution, this item does not apply.

13. **Capability to Adjust Level of Difficulty.** The capability is somewhat limited, but can be accomplished the same way as scenario manipulation (Item 11) through varying terrain, situation, and/or requirements placed on units represented by the leaders.

14. **Opposing Force Organization.** An opposing force organization would be identified in the general and initial situations presented to the participants. The OPFOR which is specified should be appropriate with respect to force ratio to the unit size/type and mission that is required.

15. **Numbers and Roles of Players.** The participants in a TEWT are always unit leaders or commanders and staff officers of the echelons at which it is conducted. Participants may span two echelons. Generally, a commander who conducts a TEWT will include all of his maneuver sub-element commanders/leaders and appropriate members of his planning staff. Six to ten individuals is an appropriate size to enable everyone to participate in the discussion.

16. **Positions With Which Players Interact.** Interaction follows chain of command and coordination among same-echelon leaders.

17. **Training Objectives That Can Be Accomplished.** A TEWT is considered effective in training small unit commanders and staff in terrain appreciation and reconnaissance techniques as well as in tactical and logistic concepts and procedures used during combat operations. Essentially, all types of missions can be planned on any terrain selected. Major emphasis is placed on identifying avenues of approach, unit boundaries, weapons placement and fields of fire, utilization of natural cover and concealment, selecting alternate routes or positions, and locating security and reserve elements.

18. **Unit/Command Group Functions (ARTEP Tasks) That Can/Cannot be Played.** Because a TEWT is primarily a planning exercise, only those ARTEP tasks related to planning are appropriate to a TEWT. Under command group tasks in

Chapter 10, ARTEP 71-2, only Task 1 and subpositions of Tasks 2, 3 and 10 are amenable to training and evaluation within a TEWT. The following tasks and subtasks are considered feasible:

Task 1: Develop Plan Based on Mission

Subtask 1-A: Analyze mission

Subtask 1-D: Analyze friendly capabilities

Subtask 1-E: Select/control key terrain

Subtask 1-F: Select routes/zones to objective

Subtask 1-G: Select battle positions

Subtask 1-H: Select delay and covering force positions

Subtask 1-I: Plan use of organic/attached and non-organic fires

Subtask 1-J: Determine which units receive priority of fire support

Subtask 3-A: Determine critical place

Subtask 3-B: Select a course of action

Subtask 3-C: Organize TF into combined arms team

Subtask 3-D: Select control measures

Subtask 3-E: Update fire plan

Four additional subtasks are considered playable to a limited degree:

Subtask 1-B: Identify critical combat information and intelligence (that portion which is terrain related)

Subtask 2-A: Identify critical combat information and intelligence (same as subtask 1-B)

Subtask 6-A: Modify plan as required by enemy action (through continued development of scenario by Exercise Director)

Subtask 10-E: Reduce vulnerability to opposing force mass destruction weapons systems (the extent to which planning provides for troop dispersion)

19. Realism of Information (Input and Feedback) Available to Players in Terms of Amount, Speed and Accuracy. This item, as it was intended, is not really applicable to TEWT. However, it is incumbent upon the user to develop a realistic situation and mission which are appropriate to the terrain and for which the unit commanders/leaders must develop a plan. Feedback in terms of critique after the plans have been developed should be based on current doctrine.

20. Requirement for Player Orientation to Training Setting. According to FM 21-6 (Appendix E), the exercise leader should begin the TEWT with a brief introduction which explains the purpose of the exercise and tasks which will be covered. The introduction is followed by presentation of the general situation and then the initial situation and requirement. Altogether, this should not take more than 30 minutes.

21. Susceptibility of Setting to "Gamesmanship." A TEWT is not considered susceptible to gamesmanship. The degree of coordination or isolation of players that would exist in the combat planning situation should be maintained in the TEWT.

22. Existence of Constraints or Required Procedures Which Are Peculiar to Setting. The most unrealistic aspects of a TEWT are the absence of troops for which the leaders would be responsible and the absence of a threat force to hinder reconnaissance. These are not considered to depreciate the TEWT for its intended purposes, nor are there procedures suspected of fostering negative learning.

23. Number of Controllers, Positions Played by Each. A TEWT does not use controllers. Ordinarily a commander will conduct a TEWT by himself or with a minimum of assistance from his designated assistants.

24. Number of Aggressor, Auxiliaries. The aggressor is not represented by a TEWT. Depending on the number of participants and the echelon at which the exercise is conducted, drivers or pilots may be required.

25. Requirement for Training Controllers, Auxiliaries. Auxiliaries or assistants are commonly instructed as the exercise proceeds.

26. Duration of Exercise. A TEWT may consist of a series of several situations and requirements over different sectors of terrain, each segment of which may last 1-2 hours. Under no circumstances would a TEWT be expected to exceed one day, and could be as little as a few hours.

27. Means for Applying Rules of Engagement, Casualty Assessment. This item does not apply.

28. Provisions/Means for Recording Player Responses. In a TEWT, each participant makes a record of his own plan, most likely on a terrain sketch or overlay. As requested, each participant then presents his plan or portion of a plan for a group discussion. These individual records may be retained by the exercise director at his option.

29. Operational Costs. Operational costs associated with a TEWT vary with a number of factors such as the size of the terrain sector, the distance from garrison, the number of participants, the duration, and possibly the echelon at which it is conducted, and a number of other factors which may impinge locally. In terms of personnel resources, excluding participants, most TEWTs should require no more than 2-3 man-days. In any case, it tends to be a very inexpensive training technique.

30. Set-Up Time. There is nothing to set up. However, the commander or exercise leader must conduct a terrain reconnaissance prior to the TEWT.

31. Means for Rating Performance. There is no rating system associated with a TEWT. After participants have reconnoitered the terrain and developed their solutions to the requirement(s) presented, a group discussion is held to review and critique the various plans put forth. Finally, the exercise leader will review the standards that he has set for the solutions and may present his own solution if it differs from others discussed.

32. Position(s) Rated by Each Controller. This item does not really apply. However, to the extent that informal rating occurs, it is done by the exercise leader of the subechelon leaders participating.

33. Objectivity of Performance Indicators/Ratings. To the extent that rating occurs, it is subjective.

34. Diagnostic Capability. A TEWT has excellent diagnostic potential relative to those training objectives for which it is intended. Each leader (participant) develops an independent solution to the situation and requirement which he discusses with the group and for which he explains his rationale. This setting gives the exercise leader a closer look at his subordinate leaders than would be possible with troops present. It affords the opportunity to observe in his subordinates the characteristics and degrees of thoroughness, innovativeness, knowledge and understanding of tactical concepts, knowledge of effects and use of terrain features, knowledge of threat tactics and capabilities of the threat force, and so on.

35. **Opportunity/Provision for Critique/Instruction.** A discussion and critique are held at the completion of developing solutions to each new presentation of situation, requirement, and terrain sector (as described in Item 31). At the end of the entire exercise (assuming that several situations are presented) the exercise leader summarizes the training objectives and standards involved in the exercise.

ANNEX D.

COMMAND POST EXERCISES (CPX)

1. **Echelon and Type Units Exercised.** Command post exercises are conducted for command groups and staffs at battalion level and higher for all types of maneuver units.

2. **Special Facilities/Equipment.** There is no requirement *per se* for special facilities or equipment to conduct a CPX. A CPX can be conducted in a classroom setting, although it is recommended that a field TOC be established. Likewise, CPX control can be set up either in a classroom or in the field. Normal organic communication systems are employed. In the control facility, there should be one master control map, and separate maps and overlays for aggressor controllers and each other control function played, such as intelligence, admin/logistics, fire support, etc. Also, firepower score tables for U.S. and aggressor weapons should be prepared in advance for the types of units involved (in accordance with guidance in Chapter 6 of FM 105-5).

3. **Means of Terrain Representation.** A CPX can be played using maps of any region selected. Standard tactical maps are used which indicate topographic relief, roads, railroads, trails, lakes, waterways, and other major terrain features, and which contain the universal military grid system. If local terrain maps are used, players can be given the opportunity to conduct terrain reconnaissance prior to the CPX.

4. **Means of Representing Weather and Other Impinging Conditions.** Consideration of the effects of weather and other conditions is totally up to the discretion and resourcefulness of the user. Generally, it would be recommended that the prevailing weather conditions at the time (and place) of the CPX be considered by the controllers as a factor in making determinations relative to rates of advancement, visibility, air operations and casualty assessments.

5. **Availability of TOE Weapon Systems Organic to the Unit.** Essentially, provision can be made by the user to represent employment of any type of weapon system or fire support available to a unit. For organic weapon systems, it is only necessary to be able to ascribe weapons effects (relative to range and target type/visibility) for each system and to require appropriate logistical support. Guidance relative to firepower scores and casualty assessment is given in FM 105-5, Maneuver Control.

6. **Availability of Non-Organic Fire Support.** (See Item 5.) It is possible to represent all types of non-organic fire support so long as weapons effects are determinable, competition for fire support is considered, and logistical support is accounted for. In addition, it is necessary to have a controller act in a liaison capacity for each category of non-organic fire support.

7. **Rules Governing Movement.** Advancement rates for various type units and factors affecting movement are presented and discussed in FM 105-5, Maneuver Control. *Application of constraints on movement relies on controller judgment.*

8. **Rules of Engagement for Weapon Systems.** Specific rules of engagement depend upon doctrine, unit SOP and user prerogative. The major factors relating to the control function are that target detection should be logical and the target should be within the effective range of the designated weapon/unit. (Casualty assessment is discussed under Item 28.)

9. **Functions of Computer.** A conventional CPX does not rely on computer utilization.

10. **Application of Probability.** FM 105-5 (Appendix D) suggests the application of dice or random number tables to determine the outcome of probabilistic events, but also states, "In the final analysis, the judgment of the controllers remains the principal factor in determining the results of player actions in any given situation."

11. **Extent to Which Scenario Can Be Manipulated to Accomplish Training Objectives.** Essentially, manipulation of the scenario within logical bounds is not constrained. The only thing in a CPX which drives the scenario (and the extent to which it is free-play or controlled) is the intent of the exercise planner. As stated in FM 105-5 (Chapter 3):

> "The scenario may be general or detailed, depending on the desires of the commander and the purpose of the exercise. Scenarios of a general nature are used in exercises designed to develop coordination in the command or in exercises used as vehicles for a training test. Scenarios of this category outline the broad aspects of the exercises, such as the mission, phase lines, times to cross phase lines, and the action of the command as a whole during each phase of the exercise. This allows greater freedom of play on the part of the participants. A detailed scenario is used when the purpose of the exercise is to correct specific deficiencies or to emphasize specific points in training. An exercise based on a detailed scenario requires close control and allows the participants less freedom of play."

FM 105-5 contains further guidance on the contents and development of scenarios.

12. **Capability to Halt Play or Replay Events.** Play can be halted at any point or revert to an earlier situation to test an alternative plan or decision at the prerogative of the exercise controller if it is desired in order to emphasize a particular teaching point. Generally, there is no provision for recording or playing back exact sequences of events.

13. **Capability to Adjust Level of Difficulty.** The level of difficulty is primarily dependent on the scenario, which is a major component of a CPX. Therefore, the level of difficulty can be adjusted in a number of ways such as increasing (decreasing) the number of scenario events that the command group has to deal with, limiting the availability of non-organic support, adjusting the OPFOR force ratio, or varying terrain and mission.

14. **Opposing Force Organization.** The OPFOR can be represented in a force ratio which is realistic for the size/type unit exercised and the assigned mission.

15. **Number and Roles of Players.** The number and role of players that are involved in a CPX is a user determination based on the purposes for the exercise, the level of complexity, and the functions that are exercised. As stated in both FM 105-5 and ARTEP 71-2, "A CPX is a field exercise for command, staff, headquarters, and communication personnel at all levels . . . . CPXs may vary in form. At one extreme is the form which resembles a map maneuver in which only key staff personnel participate . . . . At the other extreme is the form which closely simulates combat." Here, the command posts are separated by normal distances and enough headquarters and communication personnel are employed to locate, install, operate and displace the command post as in combat. A fairly typical configuration which would be comparable to the battalion-level battle simulations under consideration would involve the participation of the battalion commander, S-1, S-2, S-3, S-4, S-3 air, assistant S-3, S-1 NCO, S-4 NCO, FSO, fire support NCO, operations sergeant, intelligence sergeant, ALO and 2-3 RTOs.

16. **Positions With Which Players Interact.** Players interact with the brigade command group and staff, adjacent unit staffs, and company commanders, all represented by controllers. Contact is normally between functional counterparts.

17. **Training Objectives That Can Be Accomplished.** As stated in FM 105-5, "CPXs provide a valuable vehicle for training in displacement of headquarters; use of staff procedures, techniques, and standing operating procedures; use of alternate or fragmented command post echelons; maintenance of command and control under adverse conditions; and rehearsals for field exercises and maneuvers . . . . Command post exercises afford commanders a valuable training device in the area of combat services support." With appropriate planning and preparation, all ARTEP tasks and most subtasks specified for the battalion command group are feasible training objectives.

18. Unit/Command Group Functions (ARTEP Tasks) That Can/Cannot Be Played. With sufficient planning and preparation, it is possible to exercise and evaluate all subtasks except the following:

3-I	Plan/employ active/passive security measures
4-A	Supervise preparations
4-B	Supervise compliance with TF order
4-C	Conduct rehearsals
10-B	Defeat or suppress opposing force's imagery intelligence effort (This can be evaluated regarding the Headquarters installation)

The execution and observability of several other tasks/subtasks was considered possible only to a limited degree:

6-C	Supervise execution
Task 10	*Secure and protect task force*
10-D	Deceive the opposing force

Subtask 6-C can be [partially] simulated by requiring the commander to move from the TOC to a remote location which has radio communication with the TOC.

Task 10 is evaluated primarily on the basis of the extent to which the OPFOR is able to gather intelligence reflecting the Task Force's strength, task organization, dispositions, vulnerabilities, capabilities, or intentions. Ordinarily in a CPX, most of this information would be readily available for the OPFOR controller(s). However, intelligence agencies can be superimposed on the exercise to determine how much ELINT, COMINT and photo intelligence they can acquire.

Two of three criteria cited under Subtask 10-D, which relate to the placing of damaged or dummy equipment and dummy positions in order to deceive the enemy, are not likely to be implemented in a CPX.

Additionally, there are a number of subtasks which are potentially playable, but which require special planning for scenario events and controllers to represent appropriate agencies or roles.

19. Realism of Information (Input and Feedback) Available to Players. Because of the wide range of ways that CPXs are organized and conducted, it is difficult to generalize with respect to the timeliness, accuracy, and amount of information that will be available to players. Like most aspects of CPXs, this is a user determination and responsibility. The amount of information depends primarily on the scenario

and the number of controllers so that a realistic level is definitely achievable. The amount of input or feedback can even be varied to adjust the difficulty of the exercise. The accuracy or relevance of inputs as reflecting consequences of player actions is an area where CPXs are often criticized. CPXs are sometimes characterized as having "canned" scenarios which are not responsive to actions taken by the command (player) group. However, a CPX may be supported by a wargaming section (as described in FM 105-5) which computes outcomes of engagements undertaken by the player group. Adding this capability contributes to the realism of feedback in terms of relevance and accuracy, but may slightly degrade timeliness. Care must be exercised that the timing of scenario events and presentation of feedback to player actions realistically considers the time and space factors that would apply in a real situation. In an overall sense, it is impossible to generalize with respect to realistic timeliness of information except to say that timeliness is roughly achievable with a proficient controller organization.

20. Requirement for Player Orientation to Training Setting. Except as local circumstances require, players need only to be briefed on the general situation in which they are involved, and issued a brigade OPORD.

21. Susceptibility of Setting to "Gamesmanship." A CPX is not generally considered susceptible to gamesmanship, in terms of presenting unrealistic features or advantages which can be exploited by players.

22. Existence of Constraints or Required Procedures Which Are Peculiar to Setting. Generally there should be no irregular procedures required of players owing to participation in a CPX. Commanders are limited in terms of being able to survey the battlefield, as is true in any setting in which troop involvement is simulated. The major constraints which can occur are with respect to the lack of realistic feedback when an exercise is completely scenario-driven and failure of controller to realistically portray time and space factors.

23. Number of Controllers, Positions Played By Each. There is no set number or organization of CPX controllers. This is true because of the great latitude in the way a CPX can be structured and employed. Guidance in FM 105-5 states, "The control organization is based on the requirements of a particular tactical exercise. It is designed to parallel the player elements participating in the exercise." The control organization would generally consist of an exercise director, a chief controller, and a control staff. The control staff would consist of one or more controllers serving in each of the following functional areas:

Operations Control
Intelligence Control
Fire Support Control
TACAIR Control
CSS Control
Administrative Support
Wargaming Section

The wargaming section may consist of a map controller, a movement computer, a tactical computer and a loss computer. More comprehensive exercises may include additional personnel such as air defense controllers, engineer controllers, medical controllers, etc. The chief controller may serve also as the OPFOR controller, or one or two separate controllers may be assigned that function. The number of controllers has been found to vary from as few as about a dozen, up to as many as four dozen.

During research conducted by the Fort Leavenworth field unit of ARI, a survey of nine battalion-level CPXs indicated that an average of nearly 32 controllers were utilized per exercise.[23]

24. **Number of Aggressors.** One or two controllers will ordinarily represent the OPFOR in a battalion-level CPX.

25. **Requirement for Training Controllers, Auxiliaries.** There is no stated training time requirement for controllers. They must be familiarized with (1) their duties, (2) the scenario, and (3) rules of engagement, movement, casualty assessment, etc. Experience has indicated that several hours per controller are necessary.

26. **Duration of Exercise.** A battalion-level CPX would typically be conducted over a period of one to three days. The duration is a user determination.

27. **Means for Applying Rules of Engagement, Casualty Assessment.** Casualty assessment may be scenario driven, or responsive to player/OPFOR interactions, or a combination of the two. In either case, it is done manually and relies on controller judgment. If a wargaming section is involved in the exercise, losses are computed according to guidance in Chapter 6 of FM 105-5, using unit firepower scores.

28. **Provisions/Means for Recording Player Responses.** The decision to record player actions and the purposes and means for doing so are a user determination. The Training and Evaluation Outlines (T&EOs) contained in Chapter 10 of ARTEP 71-2 represent one option.

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[23]Ira T. Kaplan and Herbert F. Barber, *op. cit.*

29. **Operational Costs.** Operational costs for a CPX consist primarily of man-hours for preparation and conduct of the exercise. Because of the wide variability in the make-up and extensiveness of CPXs, a generally applicable figure cannot be stated. Average times for controller training, equipment set-up and miscellaneous categories have been found to amount to about 125 to 150 man-hours and controller resources for a two-day exercise came to around 500 man-hours for a total of around 650 man-hours. It should be noted that in addition to the above, an average of nearly 200 man-hours was consumed in scenario development and message preparation (a measure not included for other training settings).

30. **Set-Up Time.** In addition to that required to establish the tactical headquarters, controller communications and facilities must be set up. This has been found to vary widely around an average of about three man-days.

31. **Means for Rating Performance.** Means of rating and evaluating player performance is a user determination. ARTEP 71-2 is a frequently used vehicle, which applies evaluator/controller judgment.

32. **Position(s) Rated by Each Controller.** This determination is left to the user, but generally, the controller/umpire would rate players in positions in which he has experience and with which he directly interfaces during the exercise. Therefore, it is expected that the exercise director or chief controller would evaluate the battalion commander, the senior operations controller would evaluate the battalion S-3, the intelligence controller the battalion S-2, etc.

33. **Objectivity of Performance Indicators/Ratings.** Indicators and ratings of command group performance are entirely subjective.

34. **Diagnostic Capability.** As is true of almost every other factor, the diagnostic capability of a CPX is dependent upon the amount and thoroughness of preparation of the exercise and the skill with which it is conducted. A CPX, as a training setting, offers considerable diagnostic potential with respect to the appropriateness and skill with which staff procedures and interactions are executed. However, because of the dependence on controller judgment and scenario input, the tactical outcome (who won or lost) should not be considered a strong indicator of the tactical proficiency of the command group.

35. **Opportunity/Provision for Critique/Instruction.** Provision for instruction or critique is a user prerogative. There would generally be no limitation on controller counterparts providing feedback to players during the course of the exercise, if that approach is selected. It is also conceivable to halt the exercise at any point in order to interject a training point. Most CPXs would be followed by a feedback session of some type.

ANNEX E.

CATTS

1. **Echelon and Type Units Exercised.** Battalion command groups are trained in combined arms operations, utilizing mechanized, light infantry, and armor capabilities.

2. **Special Facilities/Equipment.** CATTS utilizes sophisticated facilities, computer hardware and software, and other ancillary equipment. It is only available at its home location at Fort Leavenworth (KS). There are, however, plans to make CATTS exportable via remote terminals sometime during 1979. To what extent system capabilities, especially in terms of visual displays, may be compromised in order to accomplish this, it is not currently known.

3. **Means of Terrain Representation.** CATTS is played on desert terrain—a portion of the Sinai Peninsula between the Suez Canal and the Mitla Pass. The elevation and features of the terrain are digitized in a computer data bank to a resolution of 25 meters squares. The terrain representation to the controllers is via a televised map of the region which is calibrated with the computer model of the region. Thus the computer can produce graphic overlays on the same screen which indicate unit positions, location of artillery splashes, etc. By remote control, the controllers can scan any portion of the map and change the scale at will by use of a zoom lens. The computer tracks and adjusts to all camera manipulation so that overlay symbols are accurately located. The players (battalion command group) in the TOC use 1:50,000 scale maps of the region with acetate overlays such as they would in combat. There is an effort underway to digitize and program a representation of the Fulda Gap region of West Germany into the computer. This terrain should be available for play by 1979.

4. **Means of Representing Weather and Other Impinging Conditions.** Weather and other visibility variables (day, night, smoke) are built into the program and selected by the controller. Actually, natural illumination is continually adjusted as a function of the time-of-day. These conditions automatically affect visibility, detection, casualty assessment, and mobility.

5. **Availability of TOE Weapon Systems Organic to Unit.** There is no constraint on weapon system availability.

6. **Availability of Non-Organic Fire Support.** All types of non-organic fire support can be played.

7. **Rules Governing Movement.** Rules governing movement are built into the program and cannot be altered. The rate of movement possible depends on weather conditions, terrain, type of unit, vehicle capabilities, suppression, etc.

8. **Rules of Engagement for Weapon Systems.** These too are built into the program; the order to engage is at the discretion of the company commander (controller), and the computer calculates visibility, detection probability, and if detection occurs, executes the engagement order.

9. **Functions of Computer.** The CATTS computer represents/simulates the roles of each platoon and maintains a complete combat overview. It carries out orders of the company commander (if they are executable) and reports back as a platoon leader would (information is more detailed and precise than would be provided in combat). The computer calculates line of sight, movement rates and location, weapon effects, executes all combat activities of both sides, accounts for unit assets (personnel, weapons, ammo, POL, vehicles), and records all actions/events and time of occurrence.

10. **Application of Probability.** Probability is figured into both detection *(given line of sight)* and weapons capabilities by the computer program.

11. **Extent to Which Scenario Can Be Manipulated to Accomplish Training Objectives.** Constraints on the scenario exist only in that there is but one area and that the computer is limited to dealing with 99 units (for both sides combined); the latter is not seen as a practical limitation. However, in use, and in philosophy, CATTs is conducted as a free-play exercise. One person directs actions of OPFOR. Essentially, the only structured interjection is the use of EW by the intelligence controller at his discretion.

12. **Capability to Halt Play or Replay Events.** CATTS is the only simulation which has a time-sequenced record of all activities and communications. The capability is regularly used in condensed time for the After-Action Reviews to review the course of the battle and important player actions. It is also possible to reinstate units to earlier positions and situations in order to pursue a different course of battle.

13. **Capability to Adjust Level of Difficulty.** To make play easier, CATTS can be played without administrative or logistics requirements involved. It is currently used in this way for the Battle Captain's Course in the CGSC. Increasing the level of difficulty can be accomplished by assigning defense of less tenable terrain, increasing the ratio of OPFOR, by increasing radio traffic or by giving the command group additional assets to deal with.

14. **Opposing Force Organization.** Normally, the OPFOR is represented as a Motorized Rifle Regiment.

15. **Number and Roles of Players.** At least the seven-member basic battalion staff would be involved, consisting of the battalion commander, S-1, S-2, S-3, S-4, ALO and FSO. At the discretion of the commander, there may be up to nine or ten additional players; however, a typical command group consists of those listed above plus the operations NCO, intelligence NCO, the assistant S-3, and/or S-3 air, the fire support NCO, and one or two radio/telephone operators.

16. **Positions With Which Players Interact.** Players interact with company commanders, brigade and adjacent unit staffs, all represented by controllers. This relationship is depicted in Figure E-1. Contact is normally between functional counterparts.

17. **Training Objectives That Can Be Accomplished.** According to the CATRADA pamphlet, "Battle Simulations and the ARTEP," the purpose of a CATTS exercise is to "train maneuver battalion command groups to attain and sustain ARTEP standards in the control and coordination of combined arms operations. . . against a realistic enemy force." Presently, only the missions of defense and covering force operation are played during the initial exercise, followed by an attack mission on the final day.

18. **Unit/Command Group Functions (ARTEP Tasks) That Can/Cannot Be Played.** According to ARTEP 71-2, Chapter 10, primary command group Task 1 through 8 and 10 through 12 can be exercised in CATTS. Rationale for exclusion of Task 9, Manage Combat Service Support Assets, is not known. Interviews with CATRADA personnel indicate that CSS management is as fully played in CATTS as any other simulation. The ARI field unit at Fort Leavenworth, in conducting research applying ARTEP to CATTS exercises, identified 50 out of 61 command group subtasks which were observable or appropriate in the CATTS environment as currently conducted. All subtasks but the following were deemed observable:

8-8	Reinforce terrain
8-2	Plan employ active/passive security measures
8-[illegible]	Conduct rehearsals
10-5	Detect or suppress opposing force imagery intelligence effort
10-[illegible]	Detect or suppress opposing force human intelligence effort
10-[illegible]	Deceive the opposing force

10-F	Detect/impede threats to TF security
10-G	Detect/defeat opposing force air assets
12-B	React to chemical or biological attack
12-C	React to nuclear attack
12-D	React to loss of key member of command group

The play of several of the above subtasks is possible within CATTS, but would have required special provisions which were not considered warranted for the purposes of the research.

19. Realism of Information (Input and Feedback) Available to Players. The company commanders in their roles of player/controllers have a lot more detailed information available to them and in shorter time than they would have in battle. For example, they have access to information of exact enemy losses as well as of losses to their own units. Therefore, reliance is placed on the controller to "role play" and intentionally degrade and summarize the information he receives to a realistic level.

20. Requirement for Player Orientation to Training Setting. Approximately a one-half hour briefing is customarily given to incoming player command groups; however, it is maintained that no instruction is required relative to the setting *per se* since the command group will be performing its normal combat functions.

21. Susceptibility of Setting to "Gamesmanship." The sophistication of the computer system and program makes it virtually inconceivable that the system could be manipulated to advantage. Incumbent company commanders must degrade this information. Another concern is that the company commanders (player/controllers) who exercise a fair amount of discretion, may influence the battle outcome as much as the battalion command group. One other phenomenon was cited as possibly constituting gamesmanship. It has been found that the use of smoke is often effective in evading or disengaging from the enemy—also, permitting units too close with him.

22. Existence of Constraints or Required Procedures Which Are Peculiar to Setting. One constraint is the lack of more varied terrain. (No vegetation is represented in the desert.) Only two missions (defense and covering force) are typically played. Additionally, the commander cannot "walk the ground" as he might in an actual defensive mission.

23. Number of Controllers, Positions Played by Each. There are 12-14 controllers in a CATTS exercise, plus five player controllers taken from the unit in training. The five player/controllers assume roles of company commander, forward

observer, and support platoon leader. Other controller positions are filled by a permanent, full-time team of controllers. The normal configuration of the control team is as follows (see also Figure E-1):

	Chief Controller; plays brigade commander
	Brigade S-1/S-4 Controller; also plays CSS unit commanders and XOs
	Brigade S-2/S-3 Controller
4	Maneuver and support unit commanders
	Fire support controller
1-2	Forward observers
	Direct air support controller
	OPFOR controller

24. Number of Aggressor/Auxiliaries. One controller provides for all functions of the OPFOR.

25. Requirement for Training Controllers, Auxiliaries. Four hours are required to train incumbent company personnel to serve as player/controllers in order to interact, on a role-playing basis, with the battalion command group and with the control system.

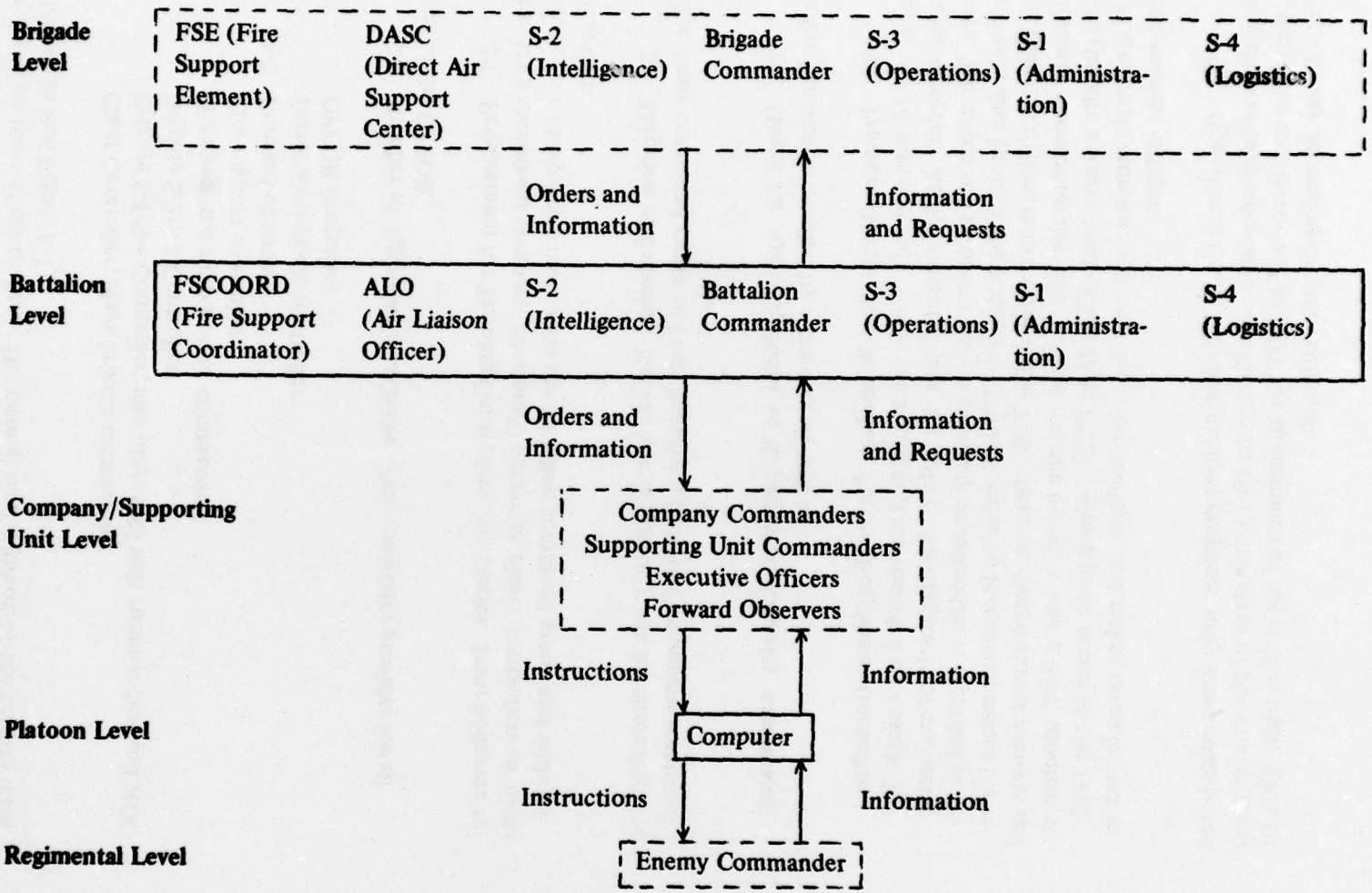
26. Duration of Exercise. The exercise is normally run for three days for an Active Army command group and two days for a Reserve Component command group.

27. Means for Applying Rules of Engagement, Casualty Assessment. This entire function is handled by computer algorithms.

28. Provision/Means for Recording Player Responses (Including Commo). All 16 wire and radio communications nets are recorded on a single 20-track tape recorder. At the present, this is not utilized for diagnostic or evaluative purposes. The execution of orders via the company commanders is recorded in the battle events data bank of the computer. While there is no formalized means for recording player activities/interactions in the TOC, there are closed circuit cameras and microphones monitoring the TOC throughout the exercise, and a TOC monitor is assigned (usually a senior-level officer from CGSC) who is given access to the TOC and the electronic monitors, oversees the entire exercise, and makes notes for use in the post-exercise critique.

29. Operational Costs. For comparative purposes, only those costs borne by the unit have been calculated. In addition to 10-15 man-days of player/controller time, the major cost factor will be TDY for all members of the visiting unit. This, of course, will vary depending on point of origin.

FIGURE E-1. Relationship Between Controller and Player Positions in CATTS
(Controller positions are inclosed by broken lines.)



SOURCE: Battalion Command Group Performance in Simulated Combat, draft research report produced by ARI, Fort Leavenworth, Kansas.

30. Set-Up Time. CATTS is set up at all times. However, it takes approximately one hour to enter unit designation and locational information, pre-planned fires, and other data into the computer.

31. Means for Rating Performance. Ratings of performance are not given to the player group. Nonetheless, controllers may keep informal notes relative to their player-counterpart's performance for use in an after-exercise critique.

32. Positions Rated by Each Controller. Controllers do not rate players systematically, but do critique their counterparts (see Item 23) on a one-to-one basis after the entire exercise.

33. Objectivity of Performance Indicators/Ratings. Objectivity of the performance indicators, in terms of battle outcomes, is presumed to be the highest available in simulations. Nonetheless, execution of battalion-level orders is dependent on player/controller interpretation of orders and some amount of discretion on the part of controllers. Evaluation by controller counterparts, while subjective, is based on well-defined functions of the Bn commander and staff.

34. Diagnostic Capability. The ability to tax and exercise the command. group is great and the opportunity to observe the command group is very good. In addition, an entire record of communications and battle actions is available. Therefore, the diagnostic potential of the setting is outstanding. However, much of the sophisticated potential of the system is not used. Nonetheless, the experienced, professional controller who has worked through numerous exercises is in a good position to recognize weaknesses in a counterpart's performance.

35. Opportunity/Provision for Critique/Instruction. A brief review of the events of the battle is presented by the OPFOR controller at the end of the first day (and second, if a three-day exercise), using a television screen which is moved into the TOC. Playback is at accelerated speed (in discrete intervals). After the last day, the chief controller and/or TOC monitor will review the major events of the whole exercise, and then the command group and controllers break out for individual critiques.

ANNEX F.

CAMMS

1. **Echelon and Type Units Exercised.** "The Computer Assisted Map Maneuver System (CAMMS) is a battle simulation designed to exercise commanders and staffs at brigade and battalion level. CAMMS is capable of accommodating an exercise consisting of armor, mechanized infantry, infantry and cavalry maneuver brigades and battalions with normal combat support (CS) and combat service support (CSS) elements in a non-nuclear environment against an appropriate enemy force."[24]

2. **Special Facilities/Equipment.** Facilities needed for CAMMS consist of a large control room (800 square feet or more desirable) and a TOC, preferably a field TOC, but an additional classroom can be used. A recommended layout of the control room is shown as Figure F-1.

A complete CAMMS kit is required; the kit consists of the map board, unit markers, controllers' guides, OPFOR tactics and doctrine guides, additional maps with acetate overlays, computer control forms, organizational work sheets for use in accounting for combat losses of personnel and equipment. A complete list of contents of the kit is contained in Appendix F-1.

Four data terminals and four commercial telephone lines are required. These are available through request from CATRADA.

Organic communications, to include FM radios and hard wire, are needed to duplicate:

a. command net
b. intelligence net
c. fire net
d. TAC AIR net
e. A/LOG net

A diagram of communications requirements for a battalion exercise is shown as Figure F-2.

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[24] "Battle Simulation and the ARTEP," Combined Arms Training Developments Activity, Fort Leavenworth, Kansas, November 1977, p. 41.

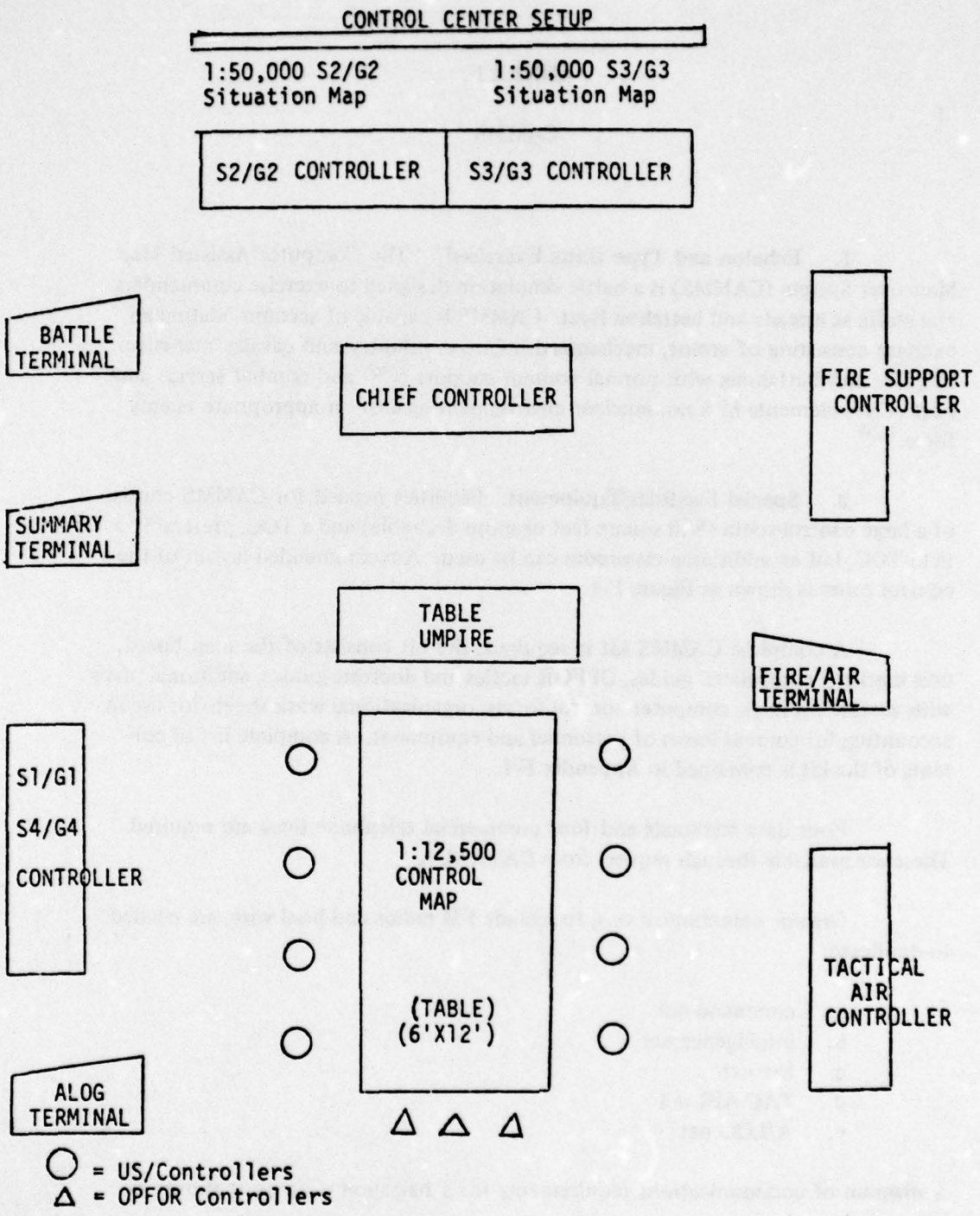
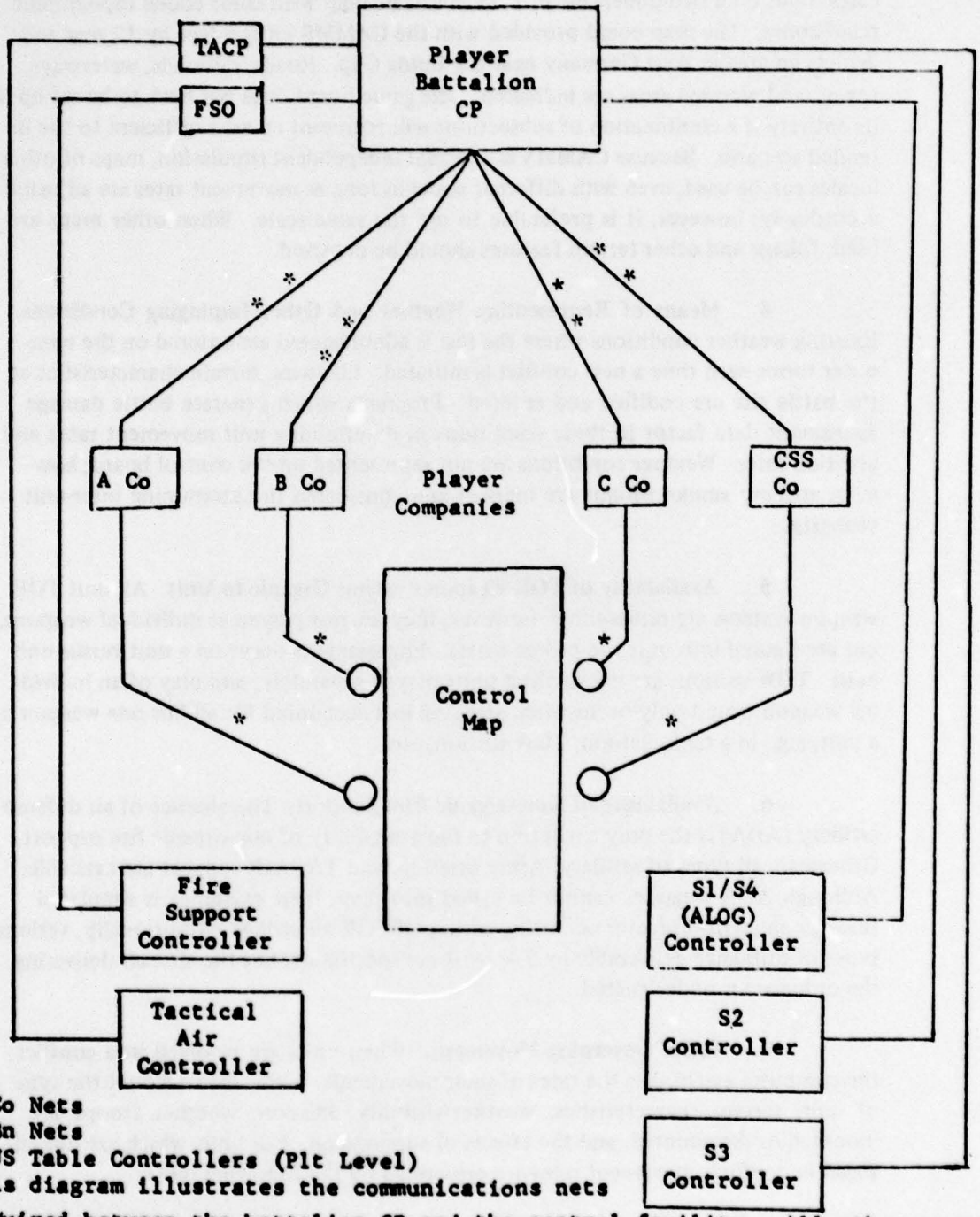


FIGURE F-1

Source: CAMMS Table Controller's Guide, CATRADA, Fort Leavenworth, Kansas.

FIGURE F-2. Communications Diagram for CAMMS Facility Battalion-Level Exercise



*Co Nets
**Bn Nets
O US Table Controllers (Plt Level)
This diagram illustrates the communications nets required between the battalion CP and the control facility. All other normal unit nets are applicable and may be established using wire or radio equipment available in Player Unit TOE.

Source: CAMMS Table Controller's Guide, CATRADA, Fort Leavenworth, Kansas.

3. **Means of Terrain Representation.** Control of a CAMMS exercise is carried out on a two-dimensional, 1:25,000 scale map with color-coded topographic relief zones. The map board provided with the CAMMS kit is 6 feet by 12 feet and depicts an area in West Germany near the Fulda Gap. Roads, railroads, waterways, towns, and wooded areas are indicated. The game board does not have to be set up in its entirety if a combination of subsections will represent an area sufficient to the intended scenario. Because CAMMS is a terrain independent simulation, maps of other locales can be used, even with different scales as long as movement rates are adjusted accordingly; however, it is preferable to use the same scale. When other maps are used, foliage and other terrain features should be depicted.

4. **Means of Representing Weather and Other Impinging Conditions.** Existing weather conditions where the test is administered are entered on the computer forms each time a new conflict is initiated. Likewise, terrain characteristics at the battle site are codified and entered. Programs which generate battle damage assessment data factor in these conditions in determining unit movement rates and attrition rates. Weather conditions are not represented on the control board; however, artillery smoke rounds are marked and considered in determining inter-unit visibility.

5. **Availability of TOE Weapon Systems Organic to Unit.** All unit TOE weapon systems are represented; however, they are not played as individual weapons, but are figured into unit fire power scores. Engagements occur on a unit versus unit basis. TOW sections are the smallest units played separately, and play of an individual weapon would only occur when attrition had accounted for all but one weapon in a unit, e.g., in a tank platoon, TOW section, etc.

6. **Availability of Non-Organic Fire Support.** The absence of air defense artillery (ADA) is the only exception to the availability of non-organic fire support. Otherwise, all types of artillery, Army aviation, and TACAIR support are available. Although ADA weapons cannot be called into play, their existence is simulated through an attrition factor occurring within OPFOR air strikes. Additionally, various types of ordnance deliverable by TACAIR are specifiable, but the aircraft delivering the ordnance is undesignated.

7. **Rules Governing Movement.** When units are involved in a conflict, the computer establishes the rates of their movements, taking into account the type of unit, terrain characteristics, weather/visibility, mission, whether troops are mounted or dismounted, and the effects of suppression. For units which are not engaged in conflict, movement rates are prescribed by the following table:

Movement Rates

(Average Unopposed) Kilometers Per Hour (KMPH)

		Day	Night
Dismounted		1.67	1.4
Tracks	Road	16.67	12.0
	Cross Country	8.34	6.0
Wheels	Road	25.00	20.0
	Cross Country	12.50	10.0
Helicopters		80.00	70.0

These rates are enforced by the Chief Controller, who uses the 1 km x 1 km grid squares to estimate allowable maneuver.

8. **Rules of Engagement for Weapon Systems.** Except for pre-planned indirect fires, detection is a prerequisite to engagement. For all types of engagements, the Friendly Table Controller (FTC) and the OPFOR Table Controller must agree that detection has occurred. Finally, for direct fire engagements, units must be within the effective range of the weapons mix of either unit. Once an engagement is decided upon, controllers determine data relative to unit involved, range, terrain, weather, unit mobility, and type of attack or defense undertaken. These data are entered into the computer which assesses casualties based on these factors, the relative firepower indices of opposing units, and the length of the conflict (i.e., attrition continues until the engagement is broken off, or until the assets on one side are totally depleted). The firepower scores used to assess damage are calculated for each conflict and are a function of the types of weapons employed, the numbers of each weapon type, the engagement range, and the prevailing visibility. Damage assessment, then is a function of relative firepower scores between engaging units, and the assets which are exposed to the conflict. Therefore, firepower scores will tend to increase as ranges become shorter, but tend to decrease as assets on both sides diminish.

9. **Functions of Computer.** There are four interactive programs run on the computer which supports a CAMMS exercise. The computer is used to execute orders relative to all types of engagements, to calculate and assess damage resulting from engagements, to keep track of personnel, ammunition, POL, and supply degradations, and to print out battle damage assessment and conflict summary reports on request. There is a separate terminal and operator for each of the four programs as depicted in the following table:

Terminal	Controller	Program	Function
1	Chief	Battle Program	Direct Fire Action
2	Chief	Summary	Furnishes periodic summaries of conflicts
3	Fires/Air	Fires/Air	Process player use of indirect fires and close air support
4	Admin/Log	Admin/Log	Logistics status and resupply

The battle program essentially creates a model of each ongoing conflict (using factors described in Item 8) and is affected by activities in the Fires/Air and Admin/Logistics programs as well. Admin/Logistics files are also adjusted to correspond to battle damage assessments. The Admin/Logistics program keeps track of the types and numbers/volumes of assets. Personnel status is maintained in five categories (officer, NCO, crewman, rifleman, warrant officer). However, the program does not identify specific identity, MOS, or positions of personnel.

10. Application of Probability. A random number generator is incorporated in the battle program which determines battle damage assessments.

11. Extent to Which Scenario Can Be Manipulated to Accomplish Training Objectives. CAMMS is scenario independent and can accommodate three types of attack and three types of defense. Scenarios can be devised and structured to exercise tasks related to specific training objectives. This would ordinarily be accomplished by way of directives from higher headquarters, inputs, or messages from controllers (e.g., S-2 or S-1/S-4), or by manipulation of OPFOR activities. To some extent, manipulation can be effected on an *ad hoc* basis during the exercise. The chief controller (acting brigade commander), the intelligence controller (brigade S-2) and the operations controller (brigade S-3) all may have considerable impact on the speed and course of the battle.

12. Capability to Halt Play or Replay Events. Play can be halted at any point at the discretion of the senior evaluator or chief controller as deemed necessary for critique or other purpose. Because the computer maintains only current status on its various files rather than record of events, the only historical data available is that on printouts which tend to be produced at irregular intervals. Additionally, the computer does not maintain coordinate position locations of units. Therefore,

recapitulation of events is dependent on notes or memories of table controllers. It is possible to start play over at an approximate earlier situation, and reinstate personnel and equipment statuses on the computer, for the purpose of trying to avoid previous errors or to experiment with alternate tactics, for example.

13. **Capability to Adjust Level of Difficulty.** Level of difficulty can be adjusted in terms of mission, for example requiring the unit to take or defend more difficult terrain, or by adjusting force ratios. Other means might involve denying or delaying fire support or resupply. Essentially, all means for adjusting difficulty relate to the purposeful structuring of the scenario for specific training objectives.

14. **Opposing Force Organization.** CAMMS can accommodate up to two motorized rifle divisions and a tank division with all their normal support units. The OPFOR for a given exercise is normally configured to represent a realistic force ratio for the mission.

15. **Number and Roles of Players.** Played at the battalion level, CAMMS is intended to exercise the battalion commander and his staff. The configuration of the battalion TOC is the prerogative of the commander. However, a basic exercise would involve six players consisting of the battalion commander, S-1/S-4, S-2, S-3, TACP and FSO.

16. **Positions With Which Players Interact.** The members of the battalion command group interact with one another and with the four company commanders who serve as player controllers. The chief evaluator acts as the brigade commander. Other controllers represent the brigade S-1/S-4, S-2, S-3, ALO and FSCOORD.

17. **Training Objectives That Can Be Accomplished.** "CAMMS is a Computer Assisted Map Maneuver System designed to exercise command, control, staff and SOP procedures at maneuver battalion and brigade level . . . . As a training vehicle and tactical laboratory, it provides the commanders and staffs the opportunity to work together under the stresses and pressures of real life battlefield situations."[25] The stated purpose of CAMMS is to train battalion and brigade command groups in:

- Command and Staff Operations
- Tactical Operations
- Coordination and Control of Combined Arms
- Administration and Logistics Support to Combat Operations

No more specific training objectives are identified in literature accompanying CAMMS. However, it appears probable that all twelve of the ARTEP command group critical tasks and most of the subtasks could be exercised.

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[25]CAMMS Table Controller's Guide, p. 1-1.

18. Unit/Command Group Functions (ARTEP Tasks) That Can/Cannot be Played. According to guidance in ARTEP 71-2, Chapter 10 (Battalion Command Group/Staff), and ARTEP 100-1 (Maneuver Brigade Command Group and Staff), CAMMS is listed as appropriate for all 12 major tasks. In a draft research report prepared by ARI at Fort Leavenworth, which compares costs and training effectiveness of CAMMS and a conventional CPX, participants (players) were asked to rate the extent to which relevant ARTEP subtasks were exercised. (The subtask ID numbers and the player positions, which rated them, are shown in Figure F-3.) The only subtasks which were not required to be rated were 1-K, "Determine fire support required," and 10-D, "Deceive the opposing force." The implication is that all other subtasks were considered playable to some extent. The reason for excluding subtask 1-K is unknown. Also, CAMMS is limited to duplicating a non-nuclear context.

19. Realism of Information (Input and Feedback) Available to Players. The CAMMS fires/air, battle and summary programs print out comprehensive damage assessment reports specifying the exact number and types of equipment and personnel losses for both friendly and enemy units at the time the printout is requested. Therefore, CAMMS provides to the company commanders/FOs more information more rapidly and more accurately than would reasonably be available in a combat situation. In addition, the company commanders and FOs, as player/controllers, have a continuous "helicopter view" of the control board. Therefore, the company commanders and FOs are required to "role play" when communicating with the battalion staff and to intentionally delay and degrade the information that is reported to keep it within realistic bounds. One function of the chief controller is to advise the player/controllers with respect to what information they could realistically observe and report. Also, specific guidance and examples are contained in the Table Controller's Guide telling player/controllers when and how much to report. There is one area in which CAMMS battle damage assessments must be supplemented, however. As indicated in Item 9, personnel casualties are identified by categories (officer, NCO, rifleman, crewman, warrant officer) and the S-1 controller should specify which position was lost to the company commander corresponding to each personnel loss. The level of detail to which this is carried is up to the user. The Administration Module developed by CATRADA for use with all battle simulations can be incorporated to fill this requirement.

At the option of the chief controller/S-2 controller, the advantage of the "helicopter view" can be offset somewhat by only placing markers for OPFOR units which are within detection range or which have been located/identified through requested reconnaissance missions.

FIGURE F-3

ARTEP Command Group Tasks
Related to CAMMS Exercise

TASK ID		POSITION	TASK ID		POSITION	TASK ID		POSITION
1	A	S-3	3	G	S-3	8	A	S-3
	B	S-2		H	S-3		B	S-3
	C	S-3		I	S-2		C	S-3
	D	S-3		J	S-1, S-4		D	S-3
	E	S-3		K	S-1, S-4			
	F	S-3				9	A	S-1, S-4
	G	S-3	4	A	S-3		B	S-1, S-4
	H	S-3		B	S-3		C	S-1, S-4
	I	FSO		C	S-3		D	S-1, S-4
	J	FSO						
	K		5	A	S-2	10	A	S-2
	L	FSO		B	S-2		B	S-2
				C	S-2		C	S-2
2	A	S-2		D	S-2		D	
	B	S-2					E	S-3
	C	S-2	6	A	S-3		F	S-3
	D	S-2		B	S-3		G	S-3
				C	S-3			
3	A	S-2, S-3		D	S-1, S-4	11	A	S-3
	B	S-3						
	C	S-3	7	A	FSO	12	A	S-2
	D	S-3		B	FSO		B	S-2
	E	S-3		C	S-3		C	S-2
	F	S-2, S-3					D	S-3

20. Requirement for Player Orientation to Training Setting. Because the bat-battalion commander and his staff will be performing their normal functions within a combat situation, no special orientation to CAMMS *per se* is required. Prior to the beginning of the exercise, they are issued an OPORD from the brigade (chief controller–about one hour) and given adequate time to plan and issue orders to their companies. Player/controllers taken from the unit require a brief orientation and rehearsal with CAMMS control board procedures which takes approximately 2½ hours.

21. Susceptibility of Setting to "Gamesmanship." Gamesmanship is not considered a problem at the command group level. The potential danger area exists if a company commander as player/controller tries to use the added information available to him in maneuvering his assets. It is up to the Table Umpire to monitor moves of the player/controllers and limit this potential, and question the basis for actions, etc. Most of the rules regarding engagements and outcomes are incorporated in the computer programs and are not readily discernible. The only advantage which might occur at the command group level is if a player/controller divulged an OPFOR disposition or intention that would not otherwise be available to the friendly command group. Again, the control group must advise and control against this, and generally it is not a problem.

22. Existence of Constraints or Required Procedures which are Peculiar to Setting. Commanders cannot see the board or make terrain reconnaissance during battle (this can be done for them by S-2 controller). They cannot employ ADA weapons (although they can go through motions of requesting support and specifying areas of coverage). According to guidance, the artillery fire controller handles all indirect fire for both friendly and OPFOR units (potential for competition for support–although this may be realistic in the sense that adjacent units would be competing for IF support). The CAMMS program does not provide for air support to the OPFOR. According to guidance, FTC and OPFOR Table Controller "work in concert." CA–CAMMS doesn't handle combat in built-up areas and is for a non-nuclear environment only.

23. Number of Controllers, Positions Played by Each. On the friendly side, there are six controllers filling the following positions:

1	Chief Controller	1	S-3 Controller
1	S-1/S-4 Controller	1	Tactical Air Controller (ALO)
1	S-2 Controller	1	Artillery Controller (FSCOORD)

Additionally, there are from 4-12 player/controllers representing the four companies of the battalion. According to the CATRADA pamphlet, "Battle Simulations and the ARTEP," page 38:

To receive maximum training benefit, player/controllers should consist of the Company Commander, the Company XO (or 1st SGT), and forward observer for each letter and CS Company. However, the player/controller functions can be executed by one representative per company if minimal admin/log play is required.

24. Number of Aggressor, Auxiliaries. CAMMS exercises generally use two OPFOR controllers, and require four terminal operators.

25. Requirement for Training Controllers, Auxiliaries. CAMMS controllers require approximately 12 hours of training over a 1½-day period. This is normally accomplished by a team from the CAMMS group at CATRADA, Fort Leavenworth. Additionally, the OPFOR controllers must study and be familiar with threat tactics and doctrine. Four supplementary documents are provided with the CAMMS kit:

a. USAITAD Report Number 14-U-76, *Military Operations of the Soviet Union.*

b. USACGSC RB 30-2, *Selected U.S. and Soviet Weapons and Equipment.*

c. USACGSC, *A Self-Evaluation on Soviet Tactics.*

d. CACDA HB 550-2, *Organization and Equipment of the Soviet Army.*

Persons who possess basic typing skills can be trained to serve as terminal operators for the CAMMS exercises in 3-4 hours.

Player/controllers need about 2½ hours of training to be oriented to the control board play, to learn to specify parameters of conflicts and fill out appropriate computer forms, and to learn their role playing function.

26. Duration of Exercise. CATRADA recommends that four hours be set as a minimum and suggests that a two-day (16 hour) exercise be a thorough workout for a battalion command group. There is actually no limit to the length of the exercise except the endurance of controllers. Provisions could even be made to rotate shifts of controllers; however, in parctice there are usually sufficient lulls in activity for staggered meal breaks and rest periods. Also, at the option of the user, the exercise could be run over several 8-hour days.

27. Means for Applying Rules of Engagement, Casualty Assessment. If controllers for either side decide to undertake an engagement, both friendly and OPFOR controllers must agree that the target unit has been detected. If the engagement is by direct fire, the chief controller must verify line of sight. Then the Friendly Table Controller and OPFOR Table Controller "work in concert to establish the parameters of the conflict which is about to begin." The battlefield variables to be specified are:

- Units to Engage
- Range
- Terrain
- Weather
- Unit Mobility
- Type of Attack/Mission

Then the form shown as CAMMS Form 1, Appendix F-2, is filled out, checked by the chief controller, and entered into the computer. The computer, based on parameters entered, calculates friendly and OPFOR attrition rates and continues to degrade unit assets accordingly as long as the battle continues (actually attrition rates change as units get closer together and as they have fewer assets remaining). The computer prints out battle damage assessments upon request.

28. Provision/Means for Recording Player Responses. The CAMMS Kit is exportable; currently there are no guides for recording player responses or communications. Accumulated printouts do provide a time-scaled record of conflicts and casualties, but do not specify unit locations. Nonetheless, the user can design and/or impose any recording system appropriate to local needs or purposes. If CAMMS is used to support an ARTEP, player responses would be recorded on Training and Evaluation Outlines (T&EOs) by evaluators positioned to observe the command group.

29. Operational Costs. (In man-days, excluding players, assuming a two-day exercise, during prime computer time.) Remote terminals are leased by CATRADA and furnished without additional charge to the user. The installation of telephone lines is incorporated in the hourly terminal hook-up rate. Currently, terminal hook-up rates are $85 per hour, Monday through Friday, between 0800 and 1700 EST/EDT, and $65 per hour during evenings and weekends. In practice, if lulls of more than an hour are anticipated in any functional area(s), the terminal(s) can be shut down in order to reduce the expense. Additional costs not figured in are fuel and special meal requirements if a field TOC is used for the exercise.

Controller Training:	16 man-days
Player/Controller Training:	2 man-days
Set-Up:	5 man-days
Execution:	38 man-days
	61 man-days

Computer Hook-Up: 2 days x 8 hours x $85/hour = $1,360

(A draft CAMMS research report prepared by ARI at Fort Leavenworth projected that a two-day CAMMS exercise cost between $5,000 and $6,000 to the user, including base salaries of all personnel—except players—and including exercise preparation time. Comparable projections for other simulations are not available.)

30. **Set-Up Time.** Facilities and equipment for a battalion-level exercise can be set up in one day by a minimum of five personnel. This includes set-up of a field TOC and organic commo.

31. **Means for Rating Performance.** There is presently no means or guidance for rating performance incorporated with the CAMMS kit. However, the proponent office in CATRADA, when conducting controller training, recommends that controllers give a verbal one-on-one critique to their player counterparts at the end of the exercise.

32. **Position(s) Rated by Each Controller.** Each controller can informally rate and critique his counterpart in the battalion staff and the exercise director or chief controller could rate the battalion commander. However, CATRADA envisions a CAMMS exercise as an opportunity for the battalion commander (player) to evaluate his own staff, and if he is to be evaluated, it should be done by the brigade commander.

33. **Objectivity of Performance Indicators/Ratings.** The only performance indicators directly associated with CAMMS are damage assessments and battle summary reports. Battle outcomes generated by the computer are essentially objective in nature. Controller judgment, however, is involved in determining conditions which are input to the computer. Controllers may evaluate player actions as battle events occur. Furthermore, battle outcomes are not fully deterministic in that a random number generator is employed in the damage assessment program.

34. **Diagnostic Capability.** There is considerable diagnostic potential in a CAMMS exercise. The exercises tend to be rich in both process and product data. However, collection and use of that data are dependent on the purposes of the user and the amount of planning and preparation that precedes the exercise. In order to

thoroughly diagnose or evaluate the command group, it is almost essential to have evaluators located in the field TOC (acting as liaison officers, for example). One significant feature of a computer-assisted simulation is that controllers tend to have more time to observe and interact with their counterparts, and thus are more likely to diagnose weaknesses that appear.

35. **Opportunity/Provision for Critique/Instruction.** Post-exercise critiques of command group performance (see Item 33) are considered an essential element of the exercise. At the user's option, controllers can be directed to instruct or coach their counterparts while the exercise is in process. If the battle has not been well managed, the senior evaluator or chief controller may choose to halt the exercise, conduct a short analysis/critique and reinstate the units at positions held earlier (see Item 12).

APPENDIX F-1

CAMMS COMPONENT LIST

MAP	
1:12,500	
PLASTIC	1 Ea
PAPER	1 Ea
1:50,000	
CGSC 50–229	40 Ea
CGSC 50–255	40 Ea
COUNTER SHEETS	5 Ea Blue
	5 Ea Red
UNIT SYMBOLS (MODELS)	
TANKS	50 Ea Blue
	75 Ea Red
APC	60 Ea Blue
	75 Ea Red
ARTY	25 Ea Blue
	10 Ea Clear
	40 Ea Red
ADA	20 Ea Blue
	20 Ea Red
CP	40 Ea Clear
TRAINS	20 Ea Blue
	20 Ea Red
HEL	12 Ea Cobra
	12 Ea UH1H
	12 Ea OH58
OTHER SYMBOLS	
AIR, ARTY, ETC (ACETATE SHEET)	1 Ea Blue
	1 Ea Red
MANUALS	
TABLE CONTROLLER GUIDE	9 Ea
TERMINAL OPERATORS GUIDE	4 Ea
S2/G2 CONTROLLERS GUIDE	2 Ea
S3/G3 CONTROLLERS GUIDE	2 Ea
ADMIN/LOG CONTROLLERS GUIDE	2 Ea
OPCODE REFERENCE GUIDE	6 Ea

CAMMS COMPONENET LIST (CONT)

FORMS 1–10	2 Ea Pads of 50
DEFENSE SCENARIO	
BRIGADE PACKAGE	4 Ea
OVERLAYS 2A & 2B, 4A & 4B	
BATTALION PACKAGE	4 Ea
OVERLAYS 2 , 3	
OFFENSIVE SCENARIO	
BRIGADE PACKAGE	4 Ea
OVERLAYS 1A & 1B	
BATTALION PACKAGE	4 Ea
OVERLAYS 1A & 1B	
G2/S2 CONTROLLER PACKAGE	1 Ea
THREAT ORDER OF BATTLE	
LIST OF TYPICAL INTELLIGENCE INDICATORS	
DEFENSE SCENARIO	
BRIGADE PACKAGE	
BATTALION PACKAGE	
OFFENSE SCENARIO	
BRIGADE PACKAGE	
BATTALION PACKAGE	
GENERAL ENEMY SITUATION OVERLAY (CONTROLLER USE ONLY)	
DEFENSE	
OFFENSE	
SPECIAL ENEMY SITUATION OVERLAY	
DEFENSE OVERLAY 1	
DEFENSE OVERLAY 2	
MILITARY OPERATIONS OF THE SOVIET ARMY	
SIGNALS	1 Box Red
	1 Box Green
	1 Box Orange

APPENDIX F-2

CAMMS Form 1

CAMMS

START BATTLE
*****START OPTION*****

_____ RANGE (Max 3,000)

Time _____

Conflict # _____

ATTACK

OPCODE (5 digits)	TERRAIN (1–10)	WEATHER (1–10)	MOUNTED/ DISMOUNTED (M/D)	TYPE ATK (1–3)

DEFENSE

OPCODE (5 digits)	TERRAIN (1–10)	WEATHER (1–10)	MOUNTED/ DISMOUNTED (M/D)	TYPE DEF (1–3)

TERRAIN MOBILITY

TYPE		
DEF	*OFF*	
10	1	Rolling, low veg
9	2	Hilly, low veg
8	3	Flat, low to no veg
7	4	Flat, med to dense veg
6	5	Rolling, med to dense veg
5	6	Hilly, med to dense veg
4	7	Rough, low veg
3	8	Rough, med to dense veg
2	9	Steep, med to dense veg
1	10	Impassable–minefields

WEATHER/OBSERVATION

TYPE	
1	Clear, bright light
2	Clear, w/overcast
3	Hazy, w/overcast
4	Cloudy, dim light
5	Fog, light to moderate also smoke
6	Darkness, w/moonlight
7	Twilight, dim light
8	Darkness, wo/moonlight
9	Fog, heavy, also suppressive artillery fire
0	Storm, heavy

Type of Attack (1–3)

1. Meeting Engagement
2. Hasty Attack
3. Deliberate Attack

Defense (1–3)

1. Delay
2. Hasty Defense
3. Prepared Defense

Preparation Use

1. Prepared by table controllers.
2. Given to table umpire/chief controller.
3. Starts a battle.
4. Results will be returned to table controller by chief controller.

ANNEX G.

PEGASUS

1. **Echelon and Type Units Exercised.** Pegasus is a battle simulation designed to exercise commanders and staff at battalion or brigade levels. It can accommodate exercises dealing with armor, mechanized infantry, infantry and cavalry units.

2. **Special Facilities or Equipment.** A Pegasus kit; separate classrooms or field tents for control board and battalion TOC in fairly close proximity (simulated TOC recommended); and communications equipment organic to the unit. The Pegasus kit consists of a 12-section 6 x 12 foot control board and player maps of the same terrain, booklets comprising an Organizer's Guide, Control Group Instructions, Rules Booklet, Combat Results Booklet, an Evaluation Guide, Offensive Scenario Inputs and Defensive Scenario Inputs, an Instructional TV cassette for use in controller training and an audio tape ECM cassette for the play of radio jamming during the exercise, and unit markers and control templates. Figures F-1 and F-2 depict, respectively, the normal requirements for battalion maneuver communications and battalion fire support communications. It is emphasized that the communications should realistically represent the facilities and nets that would be available in combat.

3. **Means of Terrain Representation.** Two dimensional map of the scale 1:12,500. The control board measures 6 x 12 feet and depicts an area near the Meiningen Gap in West Germany. Topographic relief is represented by color-coded zones and foliation is denoted symbolically. Impassable terrain features are also noted by symbols. It is intended that the control board be placed on tables. Instructions for constructing control boards representing other locales are included in the Organizer's Guide. Alternate terrain maps must be of the same 1:12,500 scale.

4. **Means of Representing Weather and Other Impinging Conditions.** There are no special provisions or rules for reducing visibility, movement or engagement outcomes as a function of weather; for practical purposes, the weather is assumed to be clear. Other weather conditions may be imposed at the discretion of the user; however, degradation of unit movement and inter-unit visibility would rely on controller judgment. The game does allow for the use of smoke and provides rules for interpreting visibility under those conditions. Additionally, provision for night play and use of artillery illumination rounds are included. The existence of terrain features, foliage and built-up areas are factored into movement, detection and engagement outcomes.

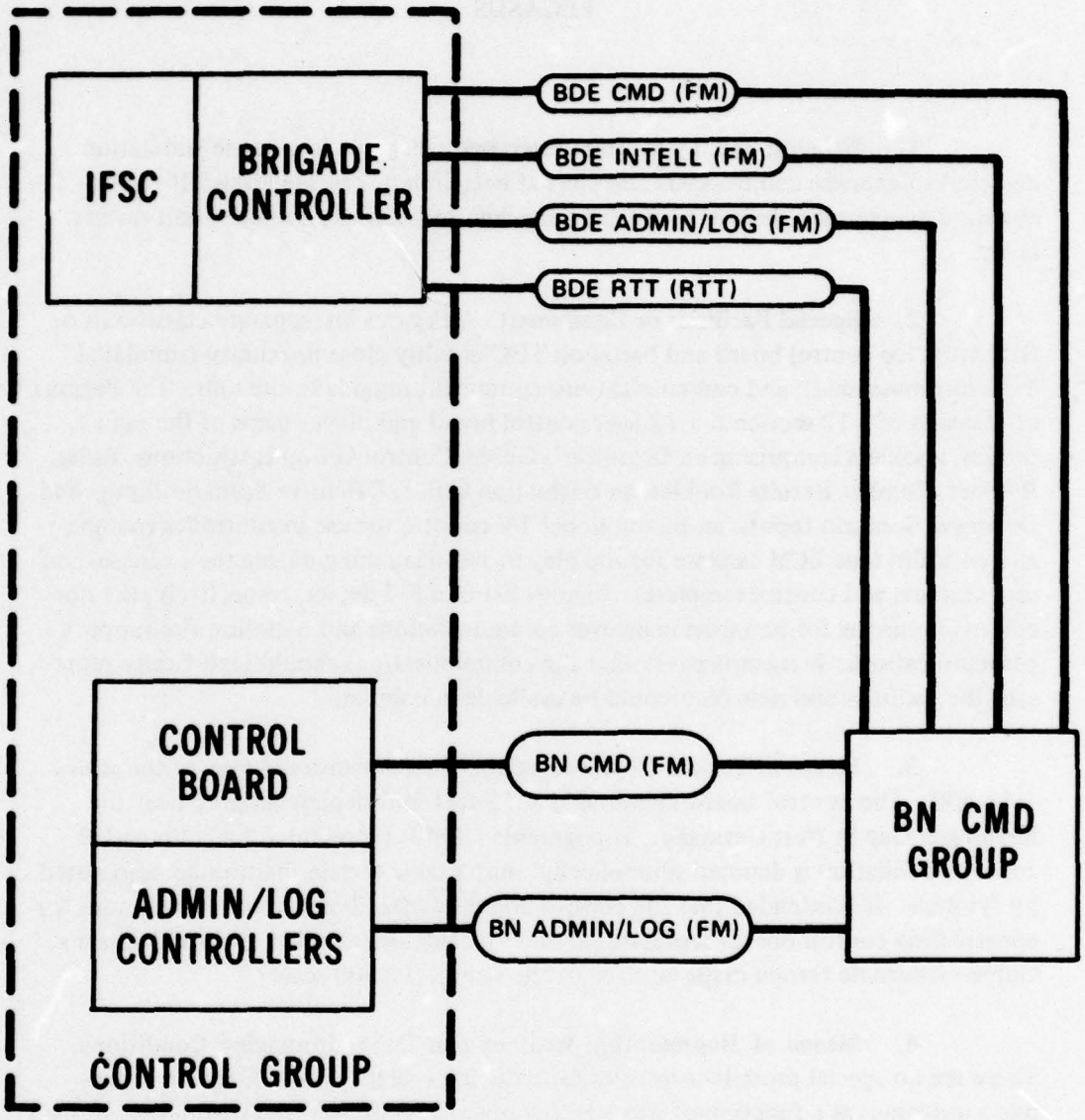

FIGURE G-1. Battalion Maneuver Unit Communications

Source: Pegasus Organizer's Guide, CATRADA, Fort Leavenworth, Kansas.

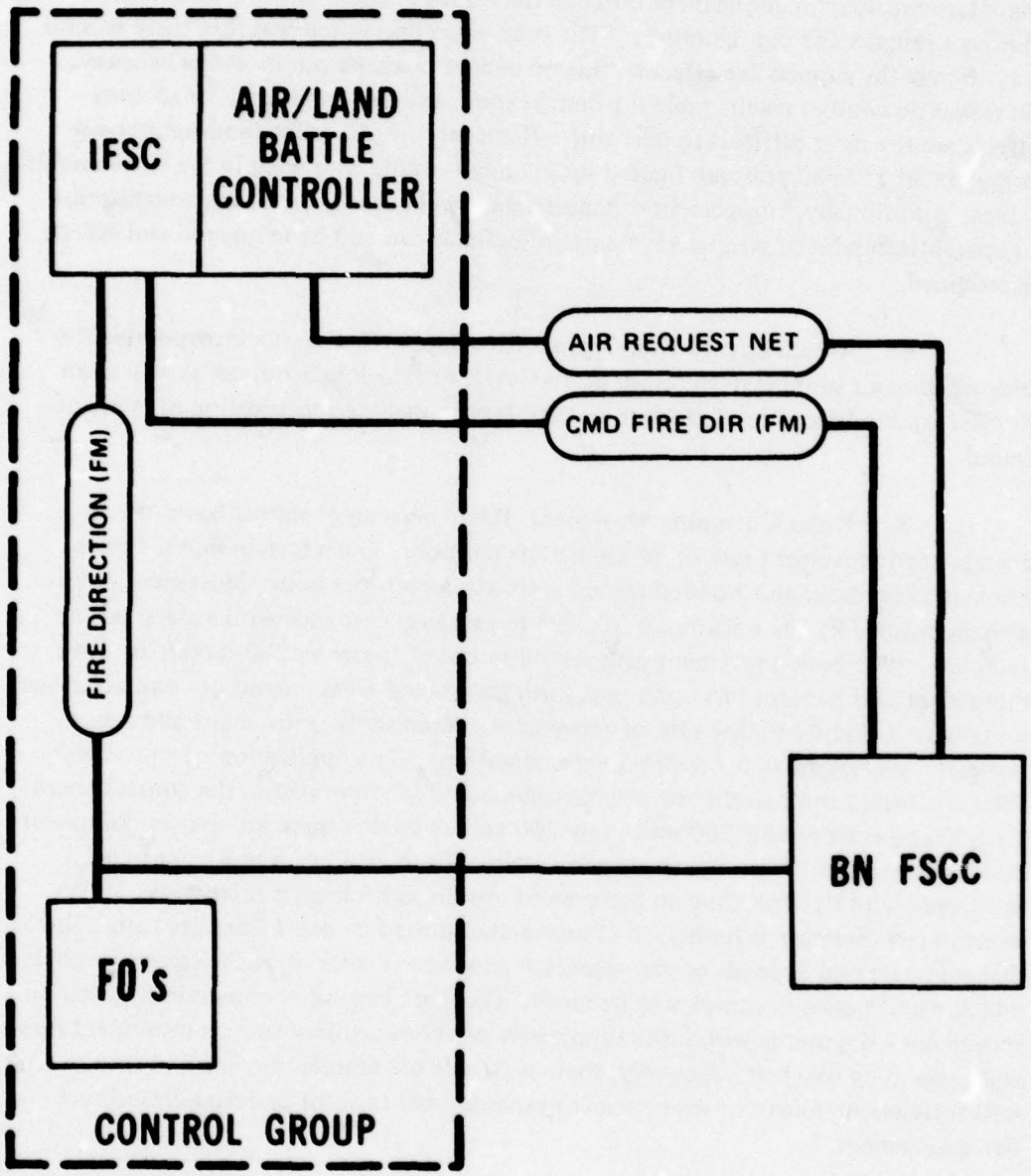

FIGURE G-2. Battalion Fire Support Communications

Source: Pegasus Organizer's Guide, CATRADA, Fort Leavenworth, Kansas.

5. **Availability of TOE Weapons Systems Organic to Unit.** All major weapons systems available to maneuver units are employable and were considered in developing inter-unit weapon engagement outcome tables for engagements between units of various strengths and configurations. The only exception noted was that there was no way to play the suppressive effect of the .50 caliber machine gun on tanks because there was no combat results table for that weapon, and that in general, small arms effects are the most difficult to deal with. However, the .50 caliber and the normal complement of small arms are figured into combat results contained in the close-assault tables. Additionally, engagement outcome tables will accommodate any organization or cross-attachment of weapons systems. Minefields can also be employed and effects determined.

6. **Availability of Non-Organic Fire Support.** Pegasus incorporates the play of close air support in the form of TAC AIR or attack helicopters, as well as air defense, and indirect fire of mortars and artillery to include specification of types of rounds.

7. **Rules Governing Movement.** Unit movement rate is based on an average road movement rate of 24 kilometers per hour. Open terrain rate is twelve kilometers per hour and wooded terrain is six kilometers per hour. Movement rate is also diminished by the occurrence of steep terrain in accordance with a steep terrain template. The basic movement rate for dismounted troops is 200 meters in three minutes or 200 meters in four minutes through rubbled areas. Scout or reconnaissance units have a slightly higher rate of movement. Necessarily, movement allowances represent average rates for approximate conditions. The application of movement rules is effected through the use of a hexagonal grid incorporated in the control board. Each hexagon represents 200 meters by 200 meters so that there are five per kilometer and 25 contained within a normal grid square. Each grid has a movement cost associated with it, depending on the type of terrain and foliage it represents. Movement in any direction is limited to 12 movement units for each 12 minute turn. The distance traversed depends on the respective movement costs of the hexagons through which a unit passes in completing its move. There are two other constraints placed on movement. If a unit is within the suppressive effect of artillery fire, its movement rate is decreased by one-half. Secondly, there is a trade-off beteeen moving and firing. A unit forfeits one-fourth of its movement potential per turn for undertaking a direct fire engagement.

8. **Rules of Engagement for Weapon Systems.** Direct fire engagement outcome tables have been developed which pose the types and number of weapons or size of engaging units against the types and number of targets or size of target unit. Different sets of outcomes exist for different range-of-engagement brackets. However,

before a direct fire engagement can occur, clear line of sight, target detection and feasible engagement range must be determined. Also, ammunition must be available. Different tables are used for deliberate fire and returned fire. Calls for indirect fire are initiated by the forward observer through the fire support controller, acting as the fire direction officer. There are limits on the availability of fire support, and there is a built-in lag time before missions are fired. Indirect fire effects depend upon proximity to the impact point, category of target, and intensity of fire. (Effects are determined through use of an IF template and appropriate tables and the roll of a die.)

9. **Function(s) of Computer (if applicable).** Not applicable.

10. **Application of Probability.** Roles of a die are used to determine target detection where line of sight and distance are not limiting factors, and also to determine which of six possible outcomes will be imposed on an engagement when the proper table has been consulted with respect to weapon type versus target type and range of engagement bracket.

11. **Extent to Which Scenario Can Be Manipulated/Modified to Accomplish Training Objectives.** Pegasus is essentially scenario independent and users are encouraged to develop their own scenarios to present particular types of problems, to emphasize or exercise particular skills, etc. Two model scenarios (offensive and defensive) are presented with the kit. The scenarios have been developed to include all orders, overlays and other necessary documentation. As a very significant addition, evaluation documentation included with Pegasus offers a large number of possible scenario inputs (113 items for offensive scenarios and 116 for defensive) which the user may choose among and which represent various situations with which the command group must cope. Accompanying guidance generally relates the two basic scenarios and scenario inputs (probes) to ARTEP command group tasks. The inputs were developed for brigade-level exercises, but for the most part could be used or modified for battaltion-level exercises. The guidance further specifies the prescribed originator and recipient for each message and a suggested elapsed exercise time for insertion.

12. **Capability to Halt or Replay Events.** Play can be halted at any point, for critique or other purposes. Recording of sequence of events is not required, therefore, exact replay of events up to a certain point is not possible, or at least subject to the memories of controllers and players. However, it is possible to retract play to an *approximate* earlier situation and to resume play at that point, perhaps to try alternate solutions or courses of action.

13. **Capability to Adjust Level of Difficulty.** Mission difficulty can be varied in terms of the ratio of forces opposed or the terrain over which the mission is

run. The play of a number of functional areas such as personnel administration, logistics, electronic warfare, and engineering operations, for example, is optional. Accompanying guidance recommends that initial experiences with the game emphasize the basic areas of command, control and coordination of maneuver units, and that as proficiency is achieved, the more comprehensive array of command group tasks be interjected/addressed.

14. Opposing Force Organization. The basic provision is for an OPFOR consisting of a Motorized Rifle Regiment or elements thereof, depending on mission and scenario. Essentially, any configuration is possible, but it is recommended that traditional attack/defense ratios be employed (c.f., FM 100-5).

15. Number and Roles of Players. "There is no prescribed organization for the player group; it consists of those individuals normally constituting the tactical operations center of the . . . battalion(s) during combat operations."[26] The player group generally comprises the commander and his staff, and the constituency will depend on the scope of the exercise and the number of functional areas played.

16. Positions With Which Players Interact. Controllers represent all subordinate, adjacent and higher units, viz., company commanders, adjacent battalion commanders or S-3s, and brigade headquarters (commander, S-2, S-1/4).

17. Training Objectives That Can Be Accomplished. "To exercise battalion . . . command groups in the performance of ARTEP tasks associated with the control and coordination of combat arms in a simulated combat environment."[27] Most training objectives which would pertain to the battalion command group are considered obtainable with Pegasus. These could include any or all twelve of the command group tasks specified in ARTEP 71-2 (Chapter 10), procedures of unit SOP, or others which might be identified. The key to achieving specific training objectives lies in careful exercise planning, and structuring the exercise scenario so as to require specific responses of the command group.

18. Unit/Command Group Functions That Can Be Played/Observed. ARTEP 71-2, Chapter 10, Command Group/Staff Tasks 1-8 and 11 are playable using the game in its basic form (see Table 1); Tasks 9, 10 and 12 require optional modules which add more functional areas to the problem; but all ARTEP tasks are playable and observable with Pegasus, according to enclosed guidance.

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[26] Pegasus Organizer's Guide, CATRADA, p. 3.

[27] *Battle Simulations and the ARTEP*, CATRADA, November 1977, p. 18.

19. Realism of Information (Input and Feedback) Available to Players. With respect to amount, speed and accuracy of transmission—unquestionably more information is available to company commander player/controllers than would be the case in combat, in terms of enemy strength, location, configuration, etc. Realistic levels of information to the TOC (i.e., to the players) are dependent on "role playing" by the company commanders and also on coaching by the chief controller relative to what the company commanders could realistically observe or surmise. It is considered likely that in practice, a little more information is available slightly faster and more accurately than it would be in combat, especially with respect to feedback of consequences from engagements. However, it is found that even under simulated conditions, some degradation of accuracy typically occurs in transmission. In any case, a great deal of prerogative exists on the part of the user with regard to information flow to the players.

20. Requirement for Player Orientation to Training Setting. "There is no requirement to conduct training for players since they will be performing normal duties apart from the control group."[28] Incumbent company commanders, who generally serve as player/controllers do require considerable training, as noted under Item 25.

21. Susceptibility of Setting to "Gamesmanship." It is considered that because the player group is isolated in the battalion TOC and does not relate to the rules of the game, that potential for gamesmanship is very low. Additionally, to the extent that there is potential, it would probably require many repeated experiences with the simulation in order to detect and develop such "advantages." Such numerous repetitions are not likely in practicality. Company commander player/controllers are susceptible to wanting to use information they have from their unrealistic vantage point. It is the responsibility of the controller group to guard against this inclination.

22. Existence of Constraints or Required Procedures Which Are Peculiar to Setting. Three major constraints were noted with respect to the simulation. Portrayal of various weather conditions was not possible, nor are operations in a built-up area. Perhaps more significant is that the battalion commander is not allowed to leave the TOC to survey the battlefield as he might during field exercises or actual combat. Additionally, realism of night operations is considered somewhat limited, and there is no provision for a partial kill of tanks. The tank's .50 cal MG cannot be used to play suppression as noted in Item 5.

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[28] Pegasus, *op. cit.*, p. 14.

23. **Number of Controllers, Positions Played by Each.**

Pegasus Control Group Requirements	
Controllers	**Battalion**
Chief Controller	1
Brigade Controller	1
Control Board Supervisor	1
OPFOR Coordinator	1
Functional Controllers	
Indirect Fire Support Controller	1
Asst. Indirect Fire Support Controller	1
OPFOR Fire Support Controller	1
Intelligence Controller	1
*Admin/Log Coordinator	1
*US Combat Functions Controller	**1-2
*E-War Controller	2

Pegasus Control Group Requirements (Continued)	
Controllers	**Battalion**
Player-Controllers	
US Unit Controller	3
Forward Observer	3
Subordinate Unit Controller	1
OPFOR Unit Controller	**2-3
*OPFOR Combat Functions Controller	

*Optional controller requirements, depending on the scope of the exercise.
**The exact number of controllers will depend on the scenario and scope of the exercise.

24. **Number of Aggressor, Auxiliaries.** Answer subsumed in Item 23.

25. Requirement for Training Controllers, Auxiliaries (Time, Special Skills). Controller training and player/controller training can normally be accomplished in 8-12 hours including practice exercises. This should be accomplished over a 1½- to 2-day period. The control board supervisor(s) responsible for controller training must first be thoroughly versed in procedures and conduct a rehearsal exercise. "Rules" and "Control Group Instructions" should be issued to controllers well in advance of controller training. Recommendations of positions most critical for controller procedural training are included in the following excerpt from the Pegasus Organizer's Guide. All controllers must be proficient in the operational areas to which their positions relate.

The amount of controller training required varies with the experience and qualifications of the individual and his assigned position. Those control group personnel involved with actual operations on the control board require fairly extensive instruction and rehearsal. These positions include:

- Control Board Supervisor
- US Unit Controller
- Forward Observer
- Subordinate Unit Controller
- Combat Functions Controller (Battalion-level exercises)
- OPFOR Coordinator
- OPFOR Unit Controller
- OPFOR Fire Support Controller
- OPFOR Combat Functions Controller

Other controllers must be familiar with the basic rules and proficient in the rules and procedures pertaining to their respective controller assignments. These positions include:

- Chief Controller
- Control Group Coordinator
- Brigade Controller

- Indirect Fire Support Controller
- Asst. Indirect Fire Support Controller
- Admin/Log Coordinator
- E-War Controller
- Intelligence Controller

26. Duration of Exercise. A Pegasus exercise will normally run for approximately six hours. "Termination may occur at the discretion of the Chief Controller. Length of the exercise will vary with the scenario, performance of controllers and players, etc. Extended exercises (beyond six hours) will require a break for the control group or a second shift of controllers." (Thus, continuation of a given exercise on a subsequent day is possible at the discretion of the users, but it is assumed that in practice most exercises are limited to one day.) In a sample Pegasus exercise timetable included in the Organizer's Guide, the situation is briefed and orders are issued to the player group two or more days in advance of the exercise to enable adequate time for planning. Then the battalion command group issues its orders to company commanders (player/controllers) on the day before the exercise. Within the final hours before the exercise is commenced, company commanders position maneuver units and CS/CSS elements on the control board in accordance with appropriate orders, and they also submit final requests for preplanned air strikes, reconnaissance flights, artillery fire plans, etc. Finally, communications checks are made on all nets. Therefore, preparatory activities, involving many of the participants, may begin several days in advance of the actual exercise.

27. Means for Applying Rules of Engagement. First, the appropriate table in the Combat Results Booklet must be identified. This will be based on the type of engagement (close assault, indirect or direct fire, and if direct, deliberate or return fire), the type of weapon systems engaging, the unit size or number of weapon systems engaging, the type and size of targets, the relative positioning or vulnerability of targets and the range of engagement. Then a die is rolled to select the corresponding column (1-6) in the table from which the engagement results are read. For direct fire engagements, line of sight visibility must be established by the control board supervisor and a die is rolled to determine if a target was detected. Different rules apply to detection probability depending on range and other conditions (type of position, activity of unit, etc.).

28. Provision/Means for Recording Player Responses (Including Commo). There are no provisions per se. Long Thrust, the predecessor to Pegasus, utilized a detailed event record throughout play. This was eventually rejected as being too cumbersome and time consuming. However, as discussed under Item 33, Pegasus evaluation guidance does include a three-point rating form, for use by evaluators, which focuses on various aspects of player performance. Therefore, this becomes a matter of user prerogative. Communications can be tape recorded and data collectors or evaluators can be positioned to observe the player group, depending on the objectives and purposes underlying the exercise.

29. Operational Costs. Assuming a one-day exercise, two days for controller training, and excluding the player group as a cost element:

Set-Up:	11 man-days
Controller Training:	22 man-days
Execution:	22 man-days
	55 man-days

There are regularly no additional materiel or operational costs to the using unit except for fuel if a field TOC is established.

30. Set-Up Time. In order to set up the control board, TOC facilities, and all necessary communication nets, it is estimated to take at least one full day on the part of 10-12 persons.

31. Means for Rating Performance. The means of rating command group performance during a Pegasus exercise depends on the purposes and intent of the user. Two means of evaluation are considered in guidance provided with Pegasus. An Evaluation/Critique Outline is included in the Evaluation Guide. The outline is a rating form bearing the heading "Command Group Evaluation Criteria." It focuses on the four functional areas of command and control, intelligence, fire support, and maneuver, and contains 18 items and 59 subitems which can be rated on a three-point scale of "poor," "good," and "outstanding." In addition, guidance is offered relative to using ARTEP training and evaluation outlines (T&EOs) in conjunction with either of the two Pegasus scenarios. Included with the guidance are a series of scenario inputs in the form of messages (113 for the offensive, 116 for the defensive) which are designed to initiate or stimulate command group execution of the critical tasks identified in the ARTEP. In the evaluation guidance, the scenario inputs are generally related to three groupings of ARTEP tasks. "Included with each set of scenario inputs is an *Input Coordination Guide* which identifies the appropriate time and responsible controller for initiating the inputs." Suggested input times are included with each, but it is recommended that discussions regarding use and timing of "probes" be based

on their appropriate correspondence to control board events. (It would appear that these same scenarios and probes could be used with other battle simulations or conventional CPXs as well or serve as a model to development of similar evaluation aids.)

32. **Position(s) Rated by Each Controller.** "Organization of the evaluation team and the evaluation plan will depend, in part, on the intent of the exercise and the desire of the commander." There is no fixed organization prescribed for an evaluation team, however, reference is made to ARTEP guidance relative to the number and grade of personnel who might be used to conduct the evaluation. It is also suggested that if less formal evaluation is intended, that controllers could serve some evaluator functions so that minimal evaluator augmentation is needed.

33. **Objectivity of Performance Indicators/Ratings.** Process ratings of individual or collective command group performance by simulation controllers or evaluators is dependent on professional judgment which is by nature subjective. The use of scenario inputs which include prescribed responses would be expected to increase inter-rater reliability. Battle outcome measures in terms of losses incurred and damage inflicted are essentially objective, although battlefield engagements do rely on controller line-of-sight judgments or interpretation of other conditions. Furthermore, assigned battle results for a particular engagement depend on the roll of a die. Other factors influencing outcome measures are force ratios, mission difficulty, the level of OPFOR play, etc. Therefore, battle outcome may satisfy the criterion of being objective, in the sense of impersonal, but at the same time are likely to reflect a complex of factors, an unknown part of which is command group skill or level of training.

34. **Diagnostic Capability (Overall).** The diagnostic potential is primarily a function of how the training setting is used and administered. The inclusion of detailed evaluation guidance does a great deal for the diagnostic capability of Pegasus exercises. On the other hand, because this is a manual simulation, the controllers must work very hard to maintain real-time progression of the battle. To maximize the diagnostic capability of the training setting, use of an evaluation team that is largely free of game administration would be advised.

35. **Opportunity for Critique/Instruction.** Play can be interrupted at any point by the Chief Controller (or Senior Evaluator, if applicable) to critique or correct performance, if it is thought to be sufficiently crucial. Furthermore, if the setting is used as a procedural trainer, it is possible to run short sequences of engagements or to stop between each turn, or even play at reduced (slower-than-realistic) speed until experience is gained in coordinating the complex tasks of conducting a battle. Post-exercise critiques of command group performance are considered an essential element of the exercise.

ANNEX H.

DUNN-KEMPF

1. **Echelon and Type Units Exercised.** Dunn-Kempf's primary focus is the company team, mechanized infantry/armor. It can be used at the company and platoon level independently. It has limited application to squads. Armored cavalry platoon and battalion scout platoon play.

2. **Special Facilities/Equipment.** Dunn-Kempf kit includes: terrain boards, miniatures, instructional videotape, viewgraphs, training script, game guidance booklets, engagement rules tables, and manual computers (whiz wheels). A table or flat surface large enough to support 10 x 8 foot combination of terrain boards. Supports for a screening curtain to go between US and OPFOR are needed. The table should be high enough so that the terrain boards are slightly below eye level when players are seated in ordinary chairs. For enhanced realism, radio or radio substitutes (field telephones) must be provided.

3. **Terrain Representation.** Terrain is represented by a molded plastic, three-dimensional terrain board. Scale is 1 inch to 50 meters horizontal, 1 inch to 25 meters vertical. Miniature vehicles are scaled 1 inch to 285 feet. Instructions are included in the kit for making terrain boards to fit unit terrain.

4. **Means of Representing Weather and Other Conditions.** Tables for reduced visibility (fog) are included in the kit. There are no specific weather-related rules, but play can be modified to accommodate reduced visibility situations. Reduced visibility situations can be simulated by placing translucent curtains across the terrain board at the desired distances. Smoke is playable from indirect and direct fire weapons. Wind/smoke interactions are played. Limited night play is possible.

5. **Availability of TOE Weapons Systems Organic to Unit.** With the exception of small arms fire, all organic weapons to armor/mechanized infantry units are available and playable.

6. **Availability of Non-Organic Fire Support.** Non-organic indirect fire support is available for 155 howitzer, 4.2 mortar and 8 inch howitzer type of rounds can be specified. Approval of fire requests is determined by die roll.

Attack helicopters and tactical air support are available with standard loads. Loads are specified by round player.

7. **Rules Governing Movement.** Movement is accomplished during each turn (board). It is limited by predicted movement possible during 30 seconds of actual combat. Allowable movement distances are specified by type of vehicle and terrain feature–for example, tanks may move 300 meters/turn on roads, 200 meters/turn across country. Controller judgment is used for difficult terrain. Movement is also controlled by suppressive direct/indirect fires during engagements. Tanks, TOWs and dragons have limited movement during turns when they fire. Movement is limited by natural/artificial obstacles and mine fields.

8. **Rules of Engagement for Weapon System.** Rules of engagement are sequentially executed on each turn for indirect fire, direct fire, and movement. A determination is first made, what vehicles, etc., can be engaged with what weapon. Factors considered in this decision are range and line of sight, distance to target, target movement, amount of cover used (hull defilade, etc.) and effective range of weapon employed. Data for use of these factors is included in tables provided by the game kit. Some controller judgment is required for firing at moving targets. There are built-in lags between call for and delivery of artillery fires. Adjustments for artillery fire may be called. Accuracy and effect (suppression, hit or kill) determinations are made by rolling the die.

Direct fire rules are employed in a similar fashion. When tanks are used as the firing weapon, players must decide whether to fire, or fire and move.

Air support by high performance aircraft and attack helicopter is treated as direct fire. However, before fire is delivered, the effect of air defense is played to decide if fires can be delivered or aborted.

9. **Computer Functions.** None.

10. **Application of Probability.** Dice roles are used to determine engagement approvals for non-organic artillery and air support fires. Dice roles are used to determine effect of engagement fires. It is assumed that the dice rolls required to hit a target for instance have been adjusted to derived data on the cumulative probability of successful engagement considering range factors of weapon, cover and movement.

11. **Extent of Scenario Flexibility to Accomplish Training Objectives.** The only scenario supplied is defense. The game is *not* bound to a defensive scenario. Any scenario involving the company/platoon mechanized infantry/armor for missions listed in Item 17 can be constructed and played if the users are willing to write the scenario. The two major means of manipulating the scenario to stress particular tasks are through structuring the respective friendly and OPFOR circumstances prior to the exercise and by directing the OPFOR course of actions during the exercise.

12. **Capability to Halt or Replay Events.** Play as it relates to combat time is naturally halted during controller action during each turn. Play can be halted at any time during the course of the game. The present set-up of the game does not make extensive records of player action, vehicle positions, movements, orders, etc. Thus, it

would be hard to go back many plays to reenact a particular development or engagement sequence. However, it would be possible, as with other manual simulations, to return the opposing forces to an approximate earlier situation to start again, perhaps to try out a different course of action.

13. **Capability to Adjust Difficulty.** Difficulty can be adjusted by varying OPFOR:US ratios, air superiority, or artillery superiority. Difficulty can be adjusted by communications jamming (EW) as is provided for in the game guide. Increasing time stress on commanders is not feasible under the present set-up. Mission difficulty in terms of terrain advantages or disadvantage is definitely variable.

14. **Opposing Force Organization.** Tank battalion and motorized rifle company can be augmented with various tasks, armored vehicles, assault helicopters and artillery.

15. **Number and Roles of Players.** Dunn-Kempf has multi-echelon flexibility. Thus, the number and roles of players depend on the echelon and roles being exercised. It is conceivable that the board and miniatures could be used for practice and demonstration of basic formations and maneuvers in which the company team leader and platoon leaders, and vehicle commanders would need to be present. Depending on purpose, these following positions and roles can be played.

Maneuver Unit	Support	OPFOR Maneuver	OPFOR Support
Company Team			
Team Commander Platoon Leaders (Opt.)	Fire Support	Battalion Co.	Artillery Coord.
Platoon (Mech or Armor)	Fir		
Platoon Leader/Platoon Sergeant/Squad Leaders	Fire Support	Company Co.	Artillery Coord.
***Platoon (Armored Cavalry)**			
Platoon Leader/Platoon Sergeant/Squad Leaders	Fire Support	Company Co.	Artillery Coord.
***Platoon (Battalion Scout)**			
Platoon Leader/Platoon Sergeant/Squad Leaders	Fire	Company Co.	Artillery Coord.

*If scout vehicles are made available.

In the above chart, support personnel can be considered players or non-players. Battalion-level players are not needed. There is no logistics play due to relatively short combat time portrayed.

16. **Positions With Which Players Interact.** The players interact with fire support personnel (if designated as non-players). The controller interacts with the players for determinations of engagement possibilities, engagement outcomes, and movement restrictions.

17. **Training Objectives That Can Be Accomplished.** The following training objectives are listed in the Dunn-Kempf Guide:

- US and Soviet small unit combined arms tactics
- Weapons systems capabilities and employment techniques
- Techniques of fire
- Battlefield observation
- Employment of indirect fires and close air support
- Use of attack helicopters
- Suppression
- Obstacles and fortifications
- Use of smoke
- Communication in an electronic warfare environment
- Proper use of terrain

The following missions are considered playable at company/platoon levels as indicated:

Mission	Co Team	Tank/Mech Plt
Movement to Contact	Yes	Yes
Hasty Attack	Yes	Yes
Deliberate Attack	Yes	Yes
Defense	Yes	Yes
Delay	Yes	
Disengage (under pressure)	Yes	
Prepare Strongpoint	Yes	

The missions listed above are playable with Dunn-Kempf with the exception of individual activities such as camouflage, posting of sentries, light/noise discipline, visual signals, etc. Squad-level play is highly degraded to the point of not being recommended. The size of board may preclude a totally accurate play of Delay. Although the Dunn-Kempf guidance manual lists squad missions of Movement to Contact, Recon Patrol, and Anti-Armor or Ambush, the potential training value of squad-level exercises is quite questionable.

18. **Unit/Command Group Functions.** The command group skills most likely to be exercised are the functional areas of planning, coordinating and reporting skills at the company/platoon level. Figure H-1 represents extracts from the command group tasks and subtasks of ARTEP 71-2. A "Yes" indicates that the task/subtask can be played to some level using user-developed or provided scenarios. Refer to ARTEP 71-2 for determination of which subtasks must be omitted.

19. **Realism of Information (Input and Feedback) Available to Players.** Input concerning the scenario and maps is complete and accurate. Visual information available to the players is more than real-life. Player can be forced to keep eye-level with the board but this constricts their visual field to less than real-life. The controller judgment is used to interpret what would be within the real-life field of vision. U.S. players are able to get visual cues as to position of OPFOR elements by observing OPFOR player's movements behind the screen. This is subject to control, if needed.

Feedback concerning engagements is slow, but fairly accurate according to CATRADA. The possibility of returning fires on TOWs, etc., is ambiguous. There may be built-in protection when the controller determines if a target can be engaged by range cards. In combat, there would be no overriding element on decision engagements, so an individual might engage when out of range and give away his position.

FIGURE H-1

TASK:	Company Team
1. Develop Task Based On Mission	
Analyze Mission	Yes
Identify Critical Combat Information and Intelligence	Yes
Identify Critical Friendly Information	Yes
Analyze Friendly Capabilities	Yes
Select/Control Key Terrain	Yes
Select Routes/Zones to Objective	Yes
Select Battle Positions	Yes
Select Delay and Covering Force Positions	Yes
Plan Use of Organic/Attached and Non-Organic Fires	Yes
Determine Priority of Fires	Yes
Determine Fire Support Required	Yes
Conduct Initial Fire Support Coordination	Yes
2. Initiate Intelligence Preparation of the Battlefield	**No**
3. Prepare and Organize the Battlefield	
Determine Critical Place	Yes
Select a Course of Action	Yes
Organize for Combat	Yes
Select Control Measures	Yes
Plan Fires	Yes
Develop a Communication Plan	Yes
Communicate/Coordinate Plans and Orders	Yes
Reinforce Terrain (Mission dependent)	No
Plan/Employ Active/Passive Security Measures	No
Provide Supplies	No
Maintain Equipment	No
4. Troop Leading Procedures	**No**
5. See the Battlefield During the Battle	
6. Control/Coordinate Combat Operations	
Modify Scheme of Maneuver	Yes
Coordinate/Communicate Changes	Yes
Supervise Execution	Yes
Maintain the Battlefield	No
7. Employ Fires and Other Combat Support Assets	
Modify Fire Support Plan	Yes
Employ Fire Plan	Yes
Employ Other Combat Support Assets	No
8. Concentrate/Shift Combat Power	
Determine Critical Place and Time	Yes
Concentrate/Shift Combat Power in the *Attack*	Yes
Concentrate/Shift Combat Power in the *Defense* and *Retrograde*	Yes
Protect Thinly Held Areas	
9. Manage Combat Service Support Assets	**No**
10. Secure and Protect the Task Force	**No**
11. Troop Leading During the Battle	**Yes**
12. React to Special Situations	
Electronic Warfare	Yes
Chemical or Biological Attack	No
Nuclear Attack	No
Loss of Key Command Group Member	Yes

Feedback on engagement outcomes is slow. In fact, most of *actual time* spent during game is waiting for controller to determine outcomes. It is estimated that four hours of play equates to about 15 minutes of combat.

The use of radios/nets can enhance the realism of information available to players if the visual field problem is closely monitored by the controller.

20. Requirement for Player Orientation to Training Setting. Stated time to train players in the rules and roles is 1½ to 2 hours. However, user experience indicates a longer training period and instructions developed by USAREUR research team can cut training time to 1.7 hours. If unit leader must learn game and write OPORD, then another 1½ hours is required.

21. Susceptibility to Gamesmanship. Probability tables are so low with TOW gunnery that experienced players will not engage with TOWs. This can be monitored and corrected by controller. Otherwise, the game is not easily manipulated.

22. Constraints Peculiar to Setting. Small arms fire and effects are not realistically played. No attempt is made to play them. Night play is possible, but not very realistic. When radio communication nets are not used or adhered to, the realism suffers, because all players are standing next to one another.

23. Number of Controllers. See table in Item 15.

24. Number of Aggressor, Auxiliaries. As outlined in the table with Item 15, two OPFOR players are the minimum recommended. The USAREUR research team has used one OPFOR position; however, the individual used was extremely familiar with OPFOR doctrine, tactics and fire support procedures.

25. Requirement for Training Controllers and Auxiliaries. Controllers should be experienced unit leaders, proficient in U.S. and OPFOR doctrine, weapons vulnerability and capabilities. They should be equal to or higher in rank than all players; battalion commanders, S-2s, S-3s, or experienced commanders are best choices. Official training time is stated as 4-6 hours in self-training by reviewing the videotape, guidebook, and trainer script. Some experience has shown that as much as 2-3 days may be required for a controller to get completely ready to run an adequate exercise.

26. Duration of Exercise. Four to six hours are required to complete one run through the existing scenario, not including player training time. A conservative estimate of time to train and conduct an exercise is 8-10 hours.

27. Means for Applying Rules of Engagement. See Item 8.

28. Provision/Means for Rating Player Responses. None.

29. Operational Costs. In man-hours, excluding players, and assuming kit availability; a 6-hour, two-sided, free-play exercise; one controller and an assistant:

Set-Up:	3 man-hours
Controller Training:	12 man-hours
Player Orientation:	2 man-hours
Execution:	12 man-hours
	29 man-hours

Use of two OPFOR controllers opposing one player team adds approximately 16 man-hours (total 45). Normally no other operational costs should be incurred.

30. Set-Up Time. One-two hours, one-two persons; estimate without communications is two man-hours; estimate with communications is three man-hours.

31-35. There is no provision made in the present kit to record player responses or to rate players. There are no official performance indicators or ratings, diagnostic capabilities or opportunities for critiques and instruction.

Any provisions for recording, evaluating and critique of player action must be made by the users. In research applications, the game has been supplemented by the ARI/USAREUR research team to provide for player evaluation. If recording of player actions and evaluation is desired, evaluation forms can be constructed from the appropriate ARTEP T&EO for the mission(s) being run in the exercise. If scenario and observation forms are constructed, there is potential for excellent diagnostic capability of unit and unit leader tactical processes. If formal observation forms are not used, the controller can provide on-line and post-exercise critique and instruction. If the controller role is expanded in this manner, the importance of his qualifications is critical.

ANNEX I.

SMALL COMBAT UNIT EVALUATION GAME (SCUE)[29]

1. **Echelon and Type Units Exercised.** The Small Combat Unit Evaluation Game (SCUE) is a battle simulation designed to accommodate platoon and company-level combined arms exercises.

2. **Special Facilities/Equipment.** Two 8 by 12 foot game boards, or maps of any terrain appropriately modified for play (see next item); the game boards are set up on tables with an intervening partition so that players cannot see the opponent's board, but so that the controller can easily view and operate on either board. Additional requirements are markers to symbolize units, vehicles/weapon systems, smoke, indirect fire bursts, and signatures; probability tables for each type of weapon system played; and a copy of the game rules. If more than one platoon leader per team is involved, additional game boards are used and players on the same team communicate by radio (organic).

3. **Means of Terrain Representation.** The SCUE game board is a two-dimensional pictomap (scale: 1:3,125) of a training area at Fort Carson, Colorado. Superimposed on the pictomap are topographic relief lines, a universal military grid system, plus a hexagonally patterned grid system such that there are 20 hexagons per kilometer (one hexagon represents 50 meters) and, therefore, 400 hexagons per grid square. Roads, tank trails, stream beds, a dry lake, and individual trees are visible on the pictomap. Standard tactical maps of any area can be used as long as a hexagonal grid system—adjusted to scale—is superimposed and appropriate terrain features are indicated.

4. **Means of Representing Weather and Other Impinging Conditions.** Prevailing weather conditions are determined by the controller. The game rules contain guidance for degrading mobility, detection, and weapons effects under conditions of inclement weather. Such degradation is further subject to adjustment based on the controller's judgment relative to the severity of conditions and characteristics of the affected terrain, etc. There are also provisions for the use of smoke and the effects of wind on smoke.

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[29]The SCUE game was developed specifically for evaluation research purposes, not for training purposes.

5. **Availability of TOE Weapon Systems Organic to Unit.** There are currently rules and probability tables for playing the following weapon systems:

M-16	DRAGON	Grenade
M-60	Tank	.50 Cal MG
TOW	155mm	90mm RR
LAW	Claymores	4.2 mortar

Any other weapon system for which maximum effective range and probability tables (probability of hit and probability of kill by range brackets) are available can be incorporated in the game.

6. **Availability of Non-Organic Fire Support.** Rules are included for the play of mortars and artillery, to include smoke rounds. Air and air defense capabilities are not currently portrayed, primarily because of the game's focus at the lower echelons.

7. **Rules Governing Movement.** Movement rates are governed by the use of the hexagonal grid system and rules which specify the number of 50-meter hexagons which can be traversed within a game turn, depending on mode of travel and the terrain conditions that apply. The controller supervises the movement of players and determines which of the six terrain categories (or combination thereof) is applicable. There are also special rules governing the entering and leaving of stream beds, areas inaccessible to vehicles, and the impact of inclement weather.

8. **Rules of Engagement for Weapon Systems.** Before engagement can occur, detection must be determined by the controller, by verification of sighting the enemy or of auditory cues. Once detection is established, the following rules for firing apply:

a. Units can fire only if line of sight to the target is available.

b. Units cannot fire and move in the same minute.

c. Units can fire only within the range and at the rate of their weapon's capabilities.

d. If two opposing forces detect each other simultaneously, one force is randomly selected to fire first. If the second force is not destroyed, it may then fire or move, at that player's discretion.

e. If a stationary unit detects a moving unit and is able to fire, the stationary unit may conduct an *opportunity fire* at the end of that time period (if the stationary unit does not move during that time period). An opportunity fire may be conducted regardless of whether or not the moving target is out of sight by the end of that time period.

f. Hit and casualty probabilities are determined from the appropriate weapon probability chart and assessed according to REALTRAIN rules. The probability of detecting a weapon's signature is also determined from the probability chart. If a signature is detected, that unit may be fired upon by the detecting unit (provided the detecting unit does not move during the time period).

9. **Function(s) of Computer (If Applicable).** Not applicable.

10. **Application of Probability (If Applicable).** Probability, applied via probability tables and dice, is used to determine the events of target detection and target hit and kill. In the case of simultaneous sightings, it is used to determine which side will fire first.

11. **Extent to Which Scenario Can Be Manipulated to Accomplish Training Objectives.** The SCUE game was developed as a research tool and is considered to be scenario-independent. Exercises using the game have been predominantly two-sided free-play in nature; however, the scenarios have at times been structured to examine specific principles, in one instance to stress the use of infantry by armor units. Since communication with higher headquarters is generally not played, manipulation would be accomplished by way of mission assignment or direction of OPFOR maneuver (an OPFOR is not presently utilized; instead two teams freely compete). In a structured application, inputs of external events could be conveyed by the controller.

12. **Capability to Halt Play or Replay Events.** Play can be halted by the controller at any time in order to critique, instruct or for any other purpose. While the events of each player turn are not recorded, a battle maneuver diagram is maintained (by the players) with times at locations grease-marked on a clear plastic overlay. Therefore, the course of the battle is easily reconstructed, and relatively accurate replay for any intermediate point is possible.

13. **Capability to Adjust Level of Difficulty.** The difficulty of an exercise can be varied by assigning an easier or harder objective, by selection of terrain over which the mission is to be run, by adjustment of opposing force ratios, or by delaying/denying indirect fire support, as examples.

14. **Opposing Force Organization.** Any organization of opposing force is possible. In use so far, the game has pitted competing U.S. force teams against each other in force ratios appropriate to respective missions (equivalent forces for meeting engagements and ratios from 3:1 to 6:1 for attack *versus* defense scenarios). The designation of an OPFOR is projected for future use.

15. **Number and Roles of Players.** A number of player configurations have been used with the game, however, the two competing sides for any exercise have been of the same configuration. The player/player team may consist of a platoon leader only, a platoon leader and his platoon sergeant, a company team commander only, or a company team commander and three platoon leaders. When company team commanders oppose each other, it is played in the open mode, i.e., they each see all of their own elements, plus opponent elements, that have been detected. When company team commanders are augmented by platoon leaders, it is played in a closed mode such that each platoon leader has a separate game board and the battle is executed via radio communications with the company commander. Other player team configurations are possible also, including the integration of forward observers on each side.

16. **Positions With Which Players Interact.** Players on both sides interact freely with the controller (but exchanges should not be overheard by the other side). Platoon leaders and platoon sergeants (if included) play on the same board. If multiple platoon leaders play, separate game boards are used and interaction occurs via FM radio. Platoon-company interaction, if played, occurs via radio.

17. **Training Objectives That Can Be Accomplished.** Because it has been developed and used as a research setting, no systematic effort has been undertaken to determine the range of possible training objectives. At the small unit level, it is considered capable of accommodating all types of appropriate missions. The missions of attack, defense, hasty defense, delay, meeting engagement, and hasty attack have been played. In support of research, it has been used to emphasize and observe improvement in the use of artillery, use of infantry by armor, selection of maneuver routes, use of communication, and aspects of command and control by the company commander.

18. **ARTEP Command Group Functions That Can/Cannot Be Played.** Correspondence and applicability of ARTEP command tasks to the game has not been determined. It is presumed to at least equate to the Dunn-Kempf setting in this respect. Administrative and logistics functions are not played.

19. **Realism of Information (Input and Feedback) Available to Players.** During game development, a great deal of consideration was given to the amount of information available to the players with respect to knowledge of the enemy and location available to the players with respect to knowledge of the enemy and location of

adjacent units. It is likely that the player, by virtue of being able to see the whole board (although only his assets are initially displayed), will have more information about the specifics of enemy-held terrain than he would in combat. From this, he may better be able to analyze and infer enemy options. However, he may not know the enemy strength, and doesn't have knowledge of enemy locations unless the enemy has done something to disclose a position and detection has been determined by the controller. Detection of the enemy comes about by interpretation of visual or auditory cues such as dust clouds, reports of trees moving, weapon signatures, etc. Detection of adjacent friendly units (if played) occurs in the same way so that coordination with adjacent unit leaders is necessary to verify identification. (Occasionally, players have fired upon friendly locations.) Throughout the exercise it is the controller's job to interpret reality to the players, with respect to what they can do or can't do, and to challenge unrealistic actions, e.g., traversing a tank turret in heavy foliage, or transmissions of information between players not designated as having communication. Obviously, controller expertise and terrain familiarity are crucial factors to the degree of realism.

Speed of feedback is rapid if it depends solely on a controller decision (e.g., line of sight) but is somewhat delayed for results of engagements because of the need to consult probability tables for hit and kill determinations. In an overall sense, the play is considered to be in near real time. A number of exercises have been replicated as field exercises (and vice versa) using the same terrain represented on the game board and have been found to consume about the same time.

Accuracy in terms of engagement results appears to closely approximate field replications using engagement simulation means to assess casualties. Accuracy of controller decisions depends on the expertise of the individual controller and his familiarity with the actual terrain (see Item 25).

20. Requirement for Player Orientation to Training Setting. The basic player orientation requires about a half-hour and consists of allowing players to read through the rules followed by an explanation of how game turns are executed, identification of assets allocated to players and a general orientation to the exercise(s) in which they will participate. It is usually beneficial to conduct a brief practice exercise (about 20-30 minutes) to allow players to place and maneuver the game pieces and to experience a detection, an engagement, and the employment of artillery. Thus, a typical player orientation would take about an hour. Then OPORDs would be issued to each side and the game period commences.

21. Susceptibility of the Setting to "Gamesmanship." The users are unaware of any instances of successful manipulation of the game by players, and generally consider it not susceptible. They assert, however, that players will use the

same sort of tricks of deception that they do use in the field, such as calling for smoke in unoccupied areas and calling for artillery bombardment along an avenue of approach that they don't intend to use. These actions do not constitute gamesmanship because they are real options/devices available to units in combat.

22. **Existence of Constraints or Required Procedures Which are Peculiar to Setting.** Players are required to fill out forms in order to request indirect fire support, and they are also required to trace their maneuver routes as the exercise progresses. Both of these requirements supply data for research but are deviations from field procedures. Both records are also considered to provide useful feedback to players after the exercise is completed. Another point was made that players are not subject to the errors of subordinate troops, for example, fire teams can't lose their bearings and get lost in the game.

23. **Number of Controllers, Positions Played by Each.** The number of controllers needed is a function of the number of players. In the basic two-board configuration of platoon leader *versus* platoon leader (with or without platoon sergeants), or company commander *versus* company commander, only one controller is needed for all control functions. However, speed of play is enhanced by the addition of a second controller to handle indirect fire engagements for both sides. In a closed-mode company *versus* company exercise in which the three platoon leaders each work from a separate board, at least two controllers are needed and it is helpful to have an indirect fire controller. It is considered that the maximum span of control for one controller is three game boards.

24. **Number of Aggressor, Auxiliaries.** As the game has been played thus far, involving two equivalent teams, this item does not apply.

25. **Requirement for Training Controllers, Auxiliaries.** Controller training, as normally conducted, takes from 1½ to 2 days. One day is devoted to actual terrain familiarization at Fort Carson (presently the game is only used at Fort Carson), particularly to establish line-of-sight relationships. The second day is devoted to learning the rules and control functions. Generally, three controllers will be trained simultaneously so that practice exercises can be conducted with the control responsibility rotating among the three.

26. **Duration of Exercise.** The normal exercise runs 2-3 hours depending on mission and the number of players. Playing with a larger number of players prolongs the exercise.

27. **Means for Applying Rules of Engagement, Casualty Assessment.** Once detection and line-of-site (if direct fire) are verified by the controller, and the intended target is determined to be within range of the engaging weapon, a 10-sided die is rolled

by the player and the controller consults a probability table for the appropriate weapon and range bracket to yield a "hit" or "no hit" determination (for a p/h of .60, the player must have rolled 7-10 with the die to receive a "hit"). In the event of a hit, casualties are assessed according to REALTRAIN casualty and damage assessment rules. Casualty assessment for indirect fire does not rely on probability but on direct application of REALTRAIN rules by the controller who "delivers" the indirect fire.

28. **Provision/Means for Recording Player Responses (Including Commo).** Players record their own requests for indirect fire and trace their maneuver routes on terrain sketches. Time hacks are inserted along the maneuver routes to indicate time at position references. Several types of data are recorded relative to casualties, viz., the number and identity of casualties, target location, target activity at time of engagement, the type of engaging weapon, and the identity and location of the firer. These data are retained for after-action review and research purposes and are recorded by a data collector if available, or in some instances by the controller. When commo has been used, radio transmissions have been tape recorded and a data collector serving as a net control station has maintained a record of reported incidents and directives.

29. **Operational Costs.** In man-hours, excluding players and assuming that two or three missions are played which consume one day (2-3 hours each). (Note that controller training does not have to be repeated for each exercise, so that the projections below are maximal.)

	Open Mode/Two Boards (1 Controller)	Closed Mode/Six Boards (1 Indirect Fire & 2 Board Controllers)
Set-Up:	1 man-hour or less	1 man-hour
Controller training:*	16 man-hours	32 man-hours
Player Orientation:	1 man-hour	3 man-hours
Execution:	8 man-hours	24 man-hours
	26 man-hours	60 man-hours

[*Time is included for the controller trainer and controller trainee(s).]

30. **Set-Up Time.** Set-up time does not exceed one hour in any mode; players set up their own radio communications if needed.

31. **Means for Rating Performance.** Neither the ARTEP nor other rating means have been applied. Certain types of data, especially related to casualties, are collected, aggregated for numerous exercises and analyzed. However, these data are not fed back to players.

32. **Position(s) Rated by Each Controller.** While the controller does not use a rating system, he makes observations which he uses as a basis for conducting an After-Action Review.

33. **Objectivity of Performance Indicators.** Data regarding casualty assessments and times and locations thereof are essentially objective. Controller observations and feedback are subjective.

34. **Diagnostic Capability.** Potential for diagnosis is good in terms of the degree of player observability and high level of player-controller interaction. The SCUE game is considered by its users to be particularly useful for diagnosing poor maneuver, poor plan of attack, inadequate or inappropriate use of artillery, and poor adaptability in terms of adjustment of plans based on casualties taken or information gleaned with respect to opponent actions. An element of validation is inferred in that the same types of errors are observed during early field exercises as in first experience with the game.

35. **Opportunity/Provision for Critique/Instruction.** Conduct of the SCUE game is essentially based on the REALTRAIN model, and as in REALTRAIN is followed by an After-Action Review conducted by the controller. The review generally consists of a recapitulation and analysis of the conflict and its major events. This is usually accomplished by interrogating the players, asking them why they opted for certain actions, what they could have done differently, etc. At the end, the controller will usually summarize lessons that should have been learned and make any additional points he deems beneficial.